Marshfield, Massachusetts

Green Harbor River Flooding Impact Investigation

March 1993

US Army Corps of Engineers
New England Division

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	March 1993	Final Report

4. TITLE AND SUBTITLE
Green Harbor River Flooding Impact Investigation
Marshfield, Massachusetts

5. FUNDING NUMBERS

6. AUTHOR(S)
Wendell B. Mah
Charles J. Wener

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9194

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This flooding impact investigation was conducted by the New England Division, U.S. Army Corps of Engineers at the request of the Massachusetts Coastal Zone Management (MCZM) office. The study was funded under the authority provided by the Corps of Engineers' Section 206 Flood Plain Management Services (FPMS) program. The study provides a preliminary evaluation of potential flooding impacts associated with the possibility of opening a series of tidegates located at the mouth of the Green Harbor River in Marshfield, Massachusetts.

14. SUBJECT TERMS	15. NUMBER OF PAGES
tidegates, flooding impacts, tidal hydraulics study Green Harbor River	67
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to *stay within the lines* to meet *optical scanning requirements*.

Block 1. Agency Use Only *(Leave blank)*.

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C	- Contract	PR	- Project
G	- Grant	TA	- Task
PE	- Program Element	WU	- Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es). Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number. *(If known)*

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with...; Trans. of...; To be published in.... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

DOD	- See DoDD 5230.24, "Distribution Statements on Technical Documents."
DOE	- See authorities.
NASA	- See Handbook NHB 2200.2.
NTIS	- Leave blank.

Block 12b. Distribution Code.

DOD	- Leave blank.
DOE	- Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
NASA	- Leave blank.
NTIS	- Leave blank.

Block 13. Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code *(NTIS only)*.

Blocks 17. - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

EXECUTIVE SUMMARY

This flooding impact investigation was conducted by the New England Division, U.S. Army Corps of Engineers at the request of the Massachusetts Coastal Zone Management (MCZM) office. The study was funded under the authority provided by the Corps of Engineers' Section 206 Flood Plain Management Services (FPMS) program. The study provides a preliminary evaluation of potential flooding impacts associated with the possibility of opening a series of tidegates located at the mouth of the Green Harbor River in Marshfield, Massachusetts. Initial investigations indicated that with the tidegates opened, properties adjacent to the Green Harbor Marsh would experience increased flooding. Therefore, this study is limited to investigating the potential flooding impacts from rainfall runoff coincident with the normal diurnal tides. This is accomplished by performing a tidal hydraulic and a cursory rainfall/runoff analysis for the tidegate structure and adjacent Green Harbor Marsh and interior watershed. The study assumes that provisions will be in place to close the existing gates during coastal storm events.

The study found that existing low lying areas bordering the Green Harbor Marsh may presently experience flooding during significant freshwater runoff coincident with high tides. With any of the tidegates opened, the flood threat to these low lying areas will increase. During spring tide conditions and to some degree normal conditions, opening the tidegates will increase the normal pool level of the marsh, therefore reducing the amount of available storage for freshwater runoff.

This study concludes that opening any tidegates at the Dike Road Bridge for the purpose of restoring tidal flows to the Green Harbor Marsh could increase flooding of properties adjacent to the Green Harbor River. In addition, there could be resulting water quality problems due to limited flushing caused by the existing bridge restriction.

This study recommends that if the community of Marshfield and MCZM wish to investigate further the tidal restoration concept, analysis should be performed to determine an alternative measure of restoring tidal flows. Additional studies should also provide an assessment of water quality impacts and an investigation of all potential environmental impacts and benefits.

Green Harbor River
Flooding Impact Investigation
Marshfield, Massachusetts

Table of Contents

List of Appendices

List of Figures

Green Harbor River
Flooding Impact Investigation
Marshfield, Massachusetts

Table of Contents (continued)

List of Tables

Green Harbor River
Flooding Impact Investigation
Marshfield, Massachusetts

I. Study Background

In the fall of 1991, the Massachusetts Coastal Zone Management (MCZM) expressed an interest to the New England Division in investigating the potential environmental benefits that could result from opening the tidegates below the Dike Road (Route 139) bridge in Marshfield. The tidegates presently restrict tidal flows into the Green Harbor River and it is possible that changing the current mode of operation of the tidegates could restore the salt water marsh and reestablish a historic fish run, as well as increase the tidal prism with possible resulting benefits on a decreased shoaling rate of the harbor entrance channel. Encroachment of the historic marsh has taken place since the dike and tidegates were constructed and reestablishing tidal flows could increase flooding of residential and commercial properties. Before investigating the tidal restoration potential of the site, the MCZM first wished to determine if flooding was a concern.

II. Study Purpose

The purpose of this study is to provide a preliminary evaluation of the potential flooding impacts associated with the possibility of opening a series of tidegates located on Dike Road (Route 139) at the mouth of the Green Harbor River in Marshfield, Massachusetts. The tidegates presently restrict tidal flows into the Green Harbor Marsh, reducing the tidal flooding in the surrounding area.

III. Study Authority

The New England Division, U.S. Army Corps of Engineers conducted this study for the Massachusetts Coastal Zone Management office under the authority provided by the Corps of Engineers' Section 206 Flood Plain Management Services (FPMS) Program.

IV. Study Scope

This study represents a preliminary assessment of the flooding impacts associated with the concept of opening the existing tidegates. Preliminary field investigations conducted as part of this study indicated the presence of properties within the marsh which clearly would be subjected to tidal flooding during coastal storm events if the Dike Road tidegates were opened. Therefore, the scope of this

investigation was limited to looking only at the potential for flooding during rainfall events coincident to normal tidal fluctuations. It was assumed that there would be some provision for closing the existing tidegates during coastal storms.

The analysis performed as part of this investigation consists of determining the tidal hydraulics with the gate(s) open and performing a runoff analysis for the Green Harbor River watershed. The analysis is based on existing available information supplemented by limited survey of the Dike Road bridge structure. This study does not evaluate the environmental impacts and benefits of restoring tidal flows to the Green Harbor River.

V. Methodology

It was determined that the scope of this study would be limited to determining the new tidal hydraulics that would result from opening the tidegates. The analysis examined the extent of potential flooding impacts. With this goal in mind, the study took the following approach:

1) Obtain the best available topographic mapping for the areas of concern including detailed plans and profiles of the tidegate structure and Webster Street Bridge.

2) Perform a tidal hydraulic and cursory rainfall/runoff analysis;

3) Identify and discuss potential flooding impacts based on the hydraulic analysis;

A. Mapping:

Topographic maps with a contour interval of 2 feet were obtained from the town of Marshfield, Department of Public Works. These maps were prepared by Avis Airmap, Inc. under the direction of the Marshfield Board of Assessors in 1980. The scale of the original maps was 1 inch equal 100 feet. However, to facilitate the hydrologic and hydraulic analyses, the original maps were reduced to a scale of 1 inch equal 200 feet.

In addition, the U.S. Geological Survey (USGS) quadrangle for Duxbury, MA at a scale of 1:25,000 and contour interval of 10 feet provided supplemental information for the analysis.

Because there were no available detailed plans of the tidegate structure, a survey was performed of the existing structure. Based on information obtained from the survey, schematic plans of the tidegate

structure and Webster Street Bridge were developed (See Figures 2,3,5 and 6).

B. Hydrologic and Hydraulics Analyses:

1. General Background

This study focuses primarily on the potential for increased flooding that could result from modifying the tidegate structure by opening any combination of its gates. Currently, four tidegates located on the downstream face of the bridge at Dike Road restricts the tidal flow from entering the Green Harbor Marsh. Since this study was primarily concerned with the flooding effects of opening tidegates, the tidal hydraulic and rainfall/runoff analysis was limited to normal coastal conditions.

2. Description of Study Area

The Green Harbor River watershed originates in Duxbury, Massachusetts just east of State Highway Route 3 (See Figure 1). Maximum watershed elevations approach 130 feet NGVD near North Duxbury. The Green Harbor Brook begins at about elevation 50 feet NGVD and flows in a northerly direction passing through several small ponds, reservoirs, and cranberry bogs, eventually reaching elevation 0.0 feet NGVD and becoming the Green Harbor River approximately 3 miles to the northeast near Webster Street in Marshfield. Total drainage area above Webster Street is about 3.3 square miles.

Land use development in the Green Harbor River watershed is primarily residential structures along the uplands, with cranberry farms and evidence of some former gravel mining in the lowlands.

Downstream from Webster Street, the Green Harbor River meanders through Green Harbor Marsh, eventually reaching the bridge and tidegate structure at Dike Road. The total drainage area of Green Harbor Brook watershed is about 7.2 square miles. The Green Harbor Marsh encompasses several small ponds and tributaries, including Bass and Wharf Creeks.

Development along the marsh is predominantly a mix of residential and commercial. The approximate 1,400 acre marsh area includes the Green Harbor Golf Course, Winslow Cemetery, Daniel Webster Wildlife Sanctuary, Marshfield Municipal airport, a drive in theater, and there is also evidence of former gravel mining and farming operations. Generally, the developed areas appear to be located on fill at or above elevation 4 feet NGVD. Notable exceptions include the Sunrise Beach area where Plymouth Avenue, MacArthur Lane, and Johnson Terrace have minimum elevations of 3.5, 2.5, and 2.9 feet NGVD, respectively. In the Fieldston

section, Constellation Road reaches elevation 1.6 feet NGVD. The Marshfield municipal airport has an elevation of 2.7 feet NGVD on one runway. The golf course and cranberry bogs near Webster Street have reported elevations as low as 3.8 and 3.5 feet NGVD, respectively. Table 1 summarizes some of the elevations for the aforementioned locations. Elevations identified in Table 1 were obtained from the Avis topographic maps for the town of Marshfield.

Table 1
Summary of Elevations
for Potential Areas of Impact

Location Name	Elevation in Feet, NGVD
Sunrise Beach Area	
Plymouth Avenue	3.5
MacArthur Lane	2.5
Johnson Terrace	2.9
Fieldston Section	
Constellation Road	1.6
Marshfield Municipal Airport	2.7
Green Harbor Golf Course	3.8
Cranberry Bogs near Webster St.	3.5

3. Description of Dike Road Tidegate Structure

The four tidegates located on the downstream face of the Dike Road bridge restrict tidal flows from entering the Green Harbor Marsh (See Figures 2 and 4A). During low tides, normal freshwater flows leaving the marsh are controlled by four sluice board bays located on the upstream side of the Dike Road bridge (See Figures 3 and 4B). With the top of the sluice boards at -3.7 feet NGVD, an essentially freshwater pond is maintained in the Green Harbor River upstream of the bridge. During high tides, ponding of coincident freshwater runoff occurs in Green Harbor Marsh until lower tides when the tidegates reopen.

The Dike Road bridge also contains another flow restriction, a 30-inch diameter sewer pipe, passing through the interior of the bridge at a fairly low level (about -1.2 feet NGVD to -3.7 feet NGVD). Table 1 in Hydrologic and Hydraulic Appendix contains details of the bridge geometry.

4. Description of Webster Street Bridge

The Green Harbor River flows from the Webster Street cranberry bog area pass through the double arch bridge located on Webster Street. The Webster Street Bridge's dimensions are provided in Table 1 of Hydrologic and Hydraulic Appendix (See also Figures 5 and 6). The structure appears to have a minimum channel elevation close to 0.0 feet NGVD. During high freshwater runoff periods, coincident with high tides (when the Dike Road tidegates would be closed) it is expected that some ponding of freshwater runoff would occur extending up river from Webster Street.

5. Methodology

The following steps were performed in the hydrologic and hydraulic analysis:

1) Determine area-capacity relationships;
2) Develop rainfall runoff analysis;
3) Perform HEC-2 backwater model analysis; and
4) Develop a hydrologic storage routing analysis.

Area capacity relationships for the Green Harbor Marsh which extends from Dike Road to Webster Street and the cranberry bog vicinity which extends upstream from Webster Street, were developed (see Table 2 in Hydrologic and Hydraulic Appendix). A description of the mapping used for this analysis was described in a previous section. At elevation 4 feet NGVD, the marsh has a gross storage capacity of about 2,800 acre-feet and a surface area of about 1,180 acres. By contrast, the area upstream from Webster Street has only a surface area of about 43 acres and a storage capacity of 49 acre-feet at this same elevation.

Since the 7.2 square mile Green Harbor River is ungaged, the nearby gaged Old Swamp River in Weymouth, Massachusetts, with a drainage area of 4.5 square miles, was used to estimate freshwater flows for this study. Based on drainage area ratios, an average annual flow rate of about 13 cubic feet per second (cfs) was determined for Green Harbor River at Dike Road. This amounts to roughly 1 acre-foot of runoff per hour. Table 2 shows estimated peak flows and runoff volumes for 2, 10, 25 and 100 year frequency floods. Runoff volume is based on 12-hour rainfall from U.S. Weather Bureau's Technical Paper 40, dated May 1961, with assumed losses of 0.2 inches per hour. During a Standard Project Flood (SPF), which is the worst possible flood event excluding extremely rare meteorological combinations, total runoff is estimated at about 4,800 acre-feet.

A HEC-2 backwater model was developed in order to determine coincident headwater and tailwater elevations and discharges at the Dike Road bridge and tidegate structure. This was necessary due to the complex geometry at the bridge which causes high exiting velocities, extreme

turbulence, and hydraulic jumps during various flow conditions. All tidegates were assumed to be open for this analysis. In addition, the sluice boards were assumed to be removed down to an estimated future condition of -6.0 feet NGVD. The sluice boards would be removed to this elevation to insure that saltwater would not be trapped, resulting in degraded water quality. The top of sluice boards is presently at -3.7 feet NGVD, about one foot higher than bottom of the tidegates. The upstream apron at the bridge is at -6.0 feet NGVD. A range of coincident flows and tailwaters were analyzed both in the upstream and downstream directions. The result of this analysis was to develop orifice and weir discharge coefficients for high, medium, and low water conditions, respectively, which include gross head losses through the bridge (See HEC-2 output in Hydrologic and Hydraulic Appendix).

Using the above information, a hydrologic storage routing was performed for spring, mean, and neap tide conditions with all tidegates fully open. Tidal data was obtained from the National Ocean Service's Boston, Massachusetts tide gage which is the closest one to the site. Tides at Marshfield are nearly identical to those at Boston. Coincident fresh water runoff for average annual flow conditions as well as 2, 10, 25 and 100-year floods were addressed. Only astronomic tides were considered in this study. Evaluation of coastal storm surge and associated wave height, runup, and overtopping is beyond the scope of this investigation. It was assumed that some provision to close the tidegates during coastal storms would be incorporated if this concept is considered for implementation (See hydrologic routing analysis in Hydrologic and Hydraulic Appendix).

TABLE 2

MARSHFIELD, MA - DIKE ROAD BRIDGE
COINCIDENT FRESHWATER RUNOFF
(Total Drainage Area = 7.21 sq. mi.)
(Existing Conditions)

Flow event	Discharge (CFS)	Runoff Volume (Ac-Ft)
Avg. Annual	13	--
2-Yr.	300	115
10-Yr.	780	615
25-Yr.	1150	885
100-Yr.	1840	1345
SPF	--	4800 +/-

6. Results of Hydrologic and Hydraulic Analyses

a. Existing Conditions: (tidegates Closed)

Presently, under the current mode of operation with the tidegates closed, there is 1,070 acre-feet of available storage between elevation 2 feet NGVD and the sluice boards at -3.7 feet NGVD. At elevation 2 feet NGVD, areas identified in Table 1 may experience flooding. The normal pool elevation of the marsh was estimated to be about -3.6 feet NGVD. This limited available storage could result in a potential problem considering that an estimated freshwater runoff of 885 and 1,345 acre-feet occurs for the 25-year and 100-year floods, respectively. This seems to indicate that flooding of some fringe development around the marsh may currently be a problem with a significant freshwater runoff event coincident with high tide. This situation may likely be worsened by fully opening all four tidegates.

b. With Project Conditions: (tidegates Opened)

Based on the analyses, with all tidegates fully open, the Dike Road bridge structure will still impose a significant restriction to tidal flows entering and leaving the Green Harbor Marsh. Table 3 presents a summary of all tidal routings. For a maximum ocean spring tide range of 14.7 feet, a water surface fluctuation of only 0.6 foot is likely in the marsh coincident with average annual runoff. During flood flows, ponding levels in the marsh are estimated to range between approximate elevations 2.3 to 3.6 feet NGVD for 2- and 100-year floods, respectively. These ponding levels could be particularly troublesome to low lying developed areas previously described, (Table 1) having elevations in the 1.6 to 3.8 feet NGVD range. The next section will discuss the sensitivity of opening any or all of the tidegates.

VI. Potential Flooding Impacts

As discussed in the previous section, low lying areas may already experience flooding problems under the current mode of operation of the tidegates being closed. This section attempts to identify the sensitivity of fully opening 1, 2, 3 or 4 tidegates coincident with a spring tide and average annual runoff. The current water level in the Green Harbor marsh is approximately -3.6 feet NGVD. The analysis determined that the water levels during maximum spring tide with the gates opened would range from 1.3 feet NGVD with one gate opened to 2.1 feet NGVD with all four gates opened. Water level fluctuations in the marsh during the tidal cycle would only vary from 0.2 feet with one gate opened to 0.6 feet with all four gates opened (See Table 4). Since there is only 360 acre-feet of available storage in the marsh between 1.3 and 2.1 feet NGVD, it does not appear possible to open any of the four tidegates without significantly increasing the threat of flooding.

TABLE 3

MARSHFIELD, MA - DIKE RD. BRIDGE
SUMMARY OF TIDAL ROUTINGS
(All Four Tidegates Open, Sluice Boards Removed)

Location/ Condition	Tide High (ft,NGVD)	Low (ft, NGVD)	Range (ft)
Ocean/ Max. Spring Tide	7.5	-7.2	14.7
Marsh/ Max. Spring Tide			
Avg. Annual Runoff	2.1	1.5	0.6
2-Yr. Runoff	2.3	1.5	0.8
10-Yr. Runoff	2.9	1.5	1.4
25-Yr. Runoff	3.2	1.5	1.7
100-Yr. Runoff	3.6	1.5	2.1
Ocean/ Mean Tide	5.0	-4.5	9.5
Marsh/ Mean Tide			
Avg. Annual Runoff	1.4	0.6	0.8
2-Yr. Runoff	1.6	0.6	1.0
10-Yr. Runoff	2.3	0.6	1.7
25-Yr. Runoff	2.6	0.6	2.0
100-Yr. Runoff	3.2	0.6	2.6
Ocean/ Min. Neap Tide	2.7	-2.4	5.1
Marsh/ Min. Neap Tide			
Avg. Annual Runoff	0.9	0.2	0.7
2-Yr. Runoff	1.1	0.2	0.9
10-Yr. Runoff	1.7	0.2	1.5
25-Yr. Runoff	2.1	0.2	1.9
100-Yr. Runoff	2.7	0.2	2.5

of the Green Harbor Marsh will become a saltwater or brackish waterbody. Due to limited flushing, water quality impacts should be studied.

With the tidegates open, the groundwater levels around the Green Harbor Marsh could increase. Since groundwater levels affect basements, wells, leaching fields, etc., the potential changes in groundwater should be addressed.

The effects of saltwater intrusion on upstream areas need to be investigated. Specifically, the potential for saltwater intrusion into upstream cranberry bogs near the Webster Street bridge. If saltwater was found to pose a problem, the possibility of constructing a tidegate at this location would need to be considered.

b. Environmental Issues:

Attempting a change from a freshwater marsh to a more brackish or saltwater pond, will undoubtedly change the types of plant and animal species within the marsh environment. For example, one might consider the effects that saltwater will have on the mosquito population. Moreover, careful consideration should be made as to the effects that a saltwater marsh environment will have on the Daniel Webster Wildlife Sanctuary.

c. Dike Road Sewer Pipe:

Additional hydraulic analyses would be required to investigate the effects of an existing sewer pipe located under Dike Road bridge. This sewer pipe is a major restriction to flow with the tidegates open. In addition, because of the high velocities under the pipe (10 to 15 fps) cavitation could result and the extreme turbulence could also rupture the pipe.

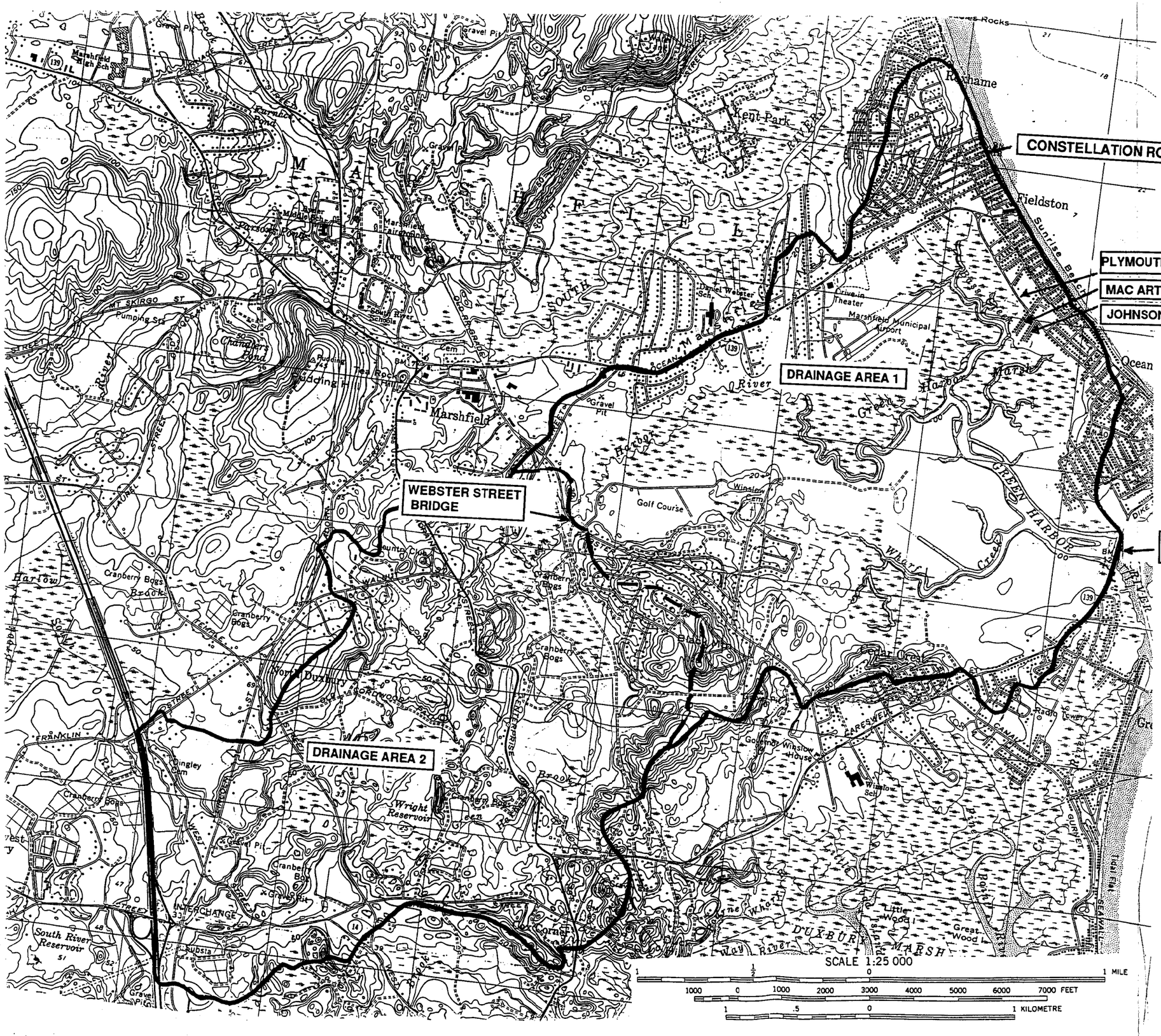
VIII. Conclusions and Recommendations

The focus of this investigation was to determine the potential flooding impacts on the Green Harbor River associated with opening the tidegates at the Dike Road Bridge. Preliminary field investigations clearly indicated the potential for flooding from coastal storm events. Therefore, the analysis performed for this investigation concentrated on the potential flooding impacts associated with rainfall runoff coincident with normal tides. The report assumes that necessary provisions are in place to close the tidegates during coastal storm surge events.

This preliminary investigation has determined that opening any of the four tidegates located on Dike Road in Marshfield, will increase the flood threat to low lying areas adjacent to the Green Harbor Marsh. During

spring tide conditions and to some degree normal conditions, opening the tidegates will increase the normal pool level of the marsh, thus reducing the amount of available storage for freshwater runoff. Moreover, this study has determined that under present operating conditions (tidegates closed), low lying areas, particularly those near the Fieldston section and Sunrise Beach, may already experience flooding problems.

This study concludes that opening the tidegates at the Dike Road Bridge for the purpose of restoring tidal flows to the Green Harbor Marsh could increase flooding of properties adjacent to the Green Harbor River and could result in potential water quality impacts due to the limited flushing caused by the existing bridge restriction. If the community of Marshfield and the MCZM wish to investigate the tidal restoration concept further, it is recommended that alternative measures for opening the tidegates be considered. Moreover, any further study should also consider in greater detail concerns related to water quality and environmental impacts.



TOTAL DRAINAGE AREA: 7.21 Sq. Mi.

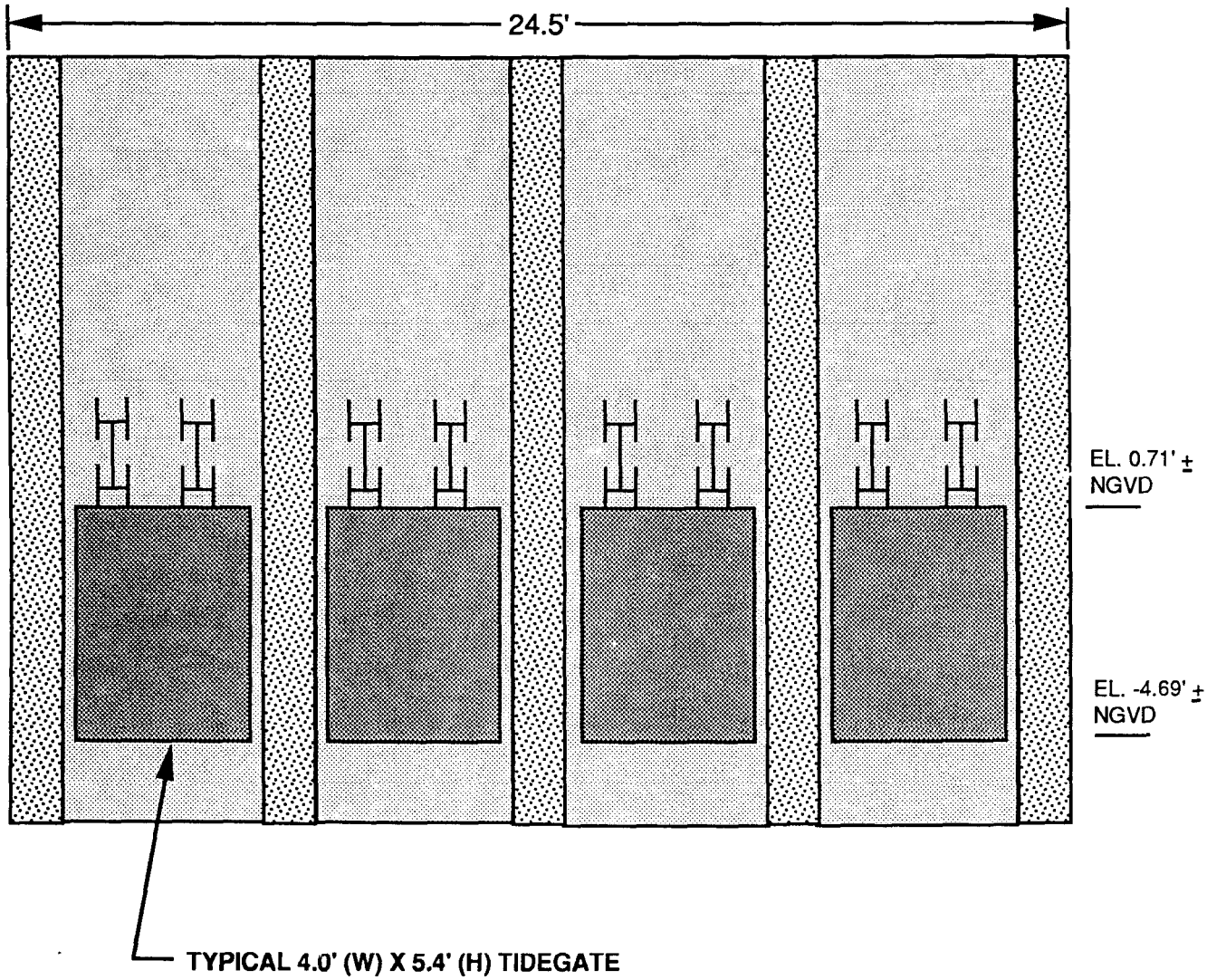
DRAINAGE AREA 1: 3.92 Sq. Mi.

DRAINAGE AREA 2: 3.29 Sq. Mi.

Drainage Area Location Map

Marshfield, Massachusetts

FIGURE 1



DIKE ROAD TIDEGATE STRUCTURE
VIEW LOOKING UPSTREAM
FROM HARBOR SIDE

SCALE: 1"= 4 FEET

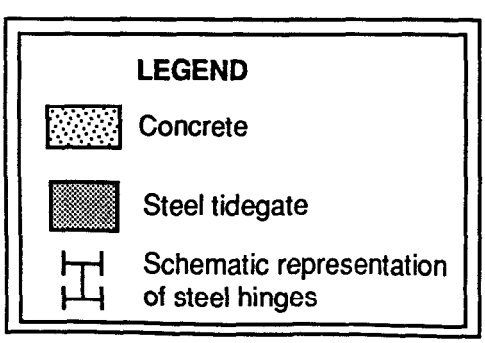
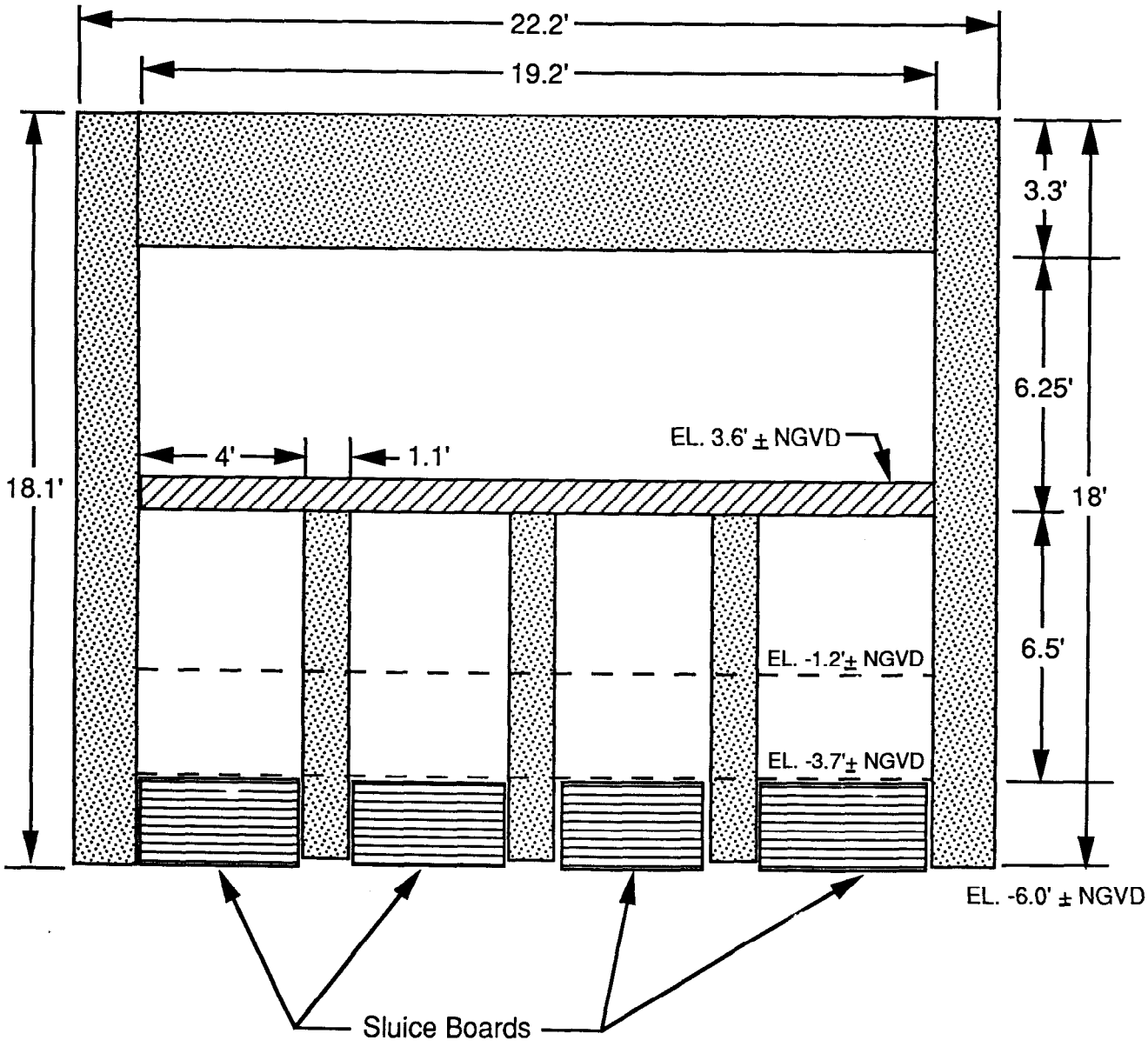


FIGURE 2



DIKE ROAD TIDEGATE STRUCTURE
VIEW LOOKING DOWNSTREAM
FROM MARSH SIDE

SCALE: 1"=4 FEET

LEGEND

- Concrete
- Concrete Sewer Pipe
- Concrete Walkway

FIGURE 3

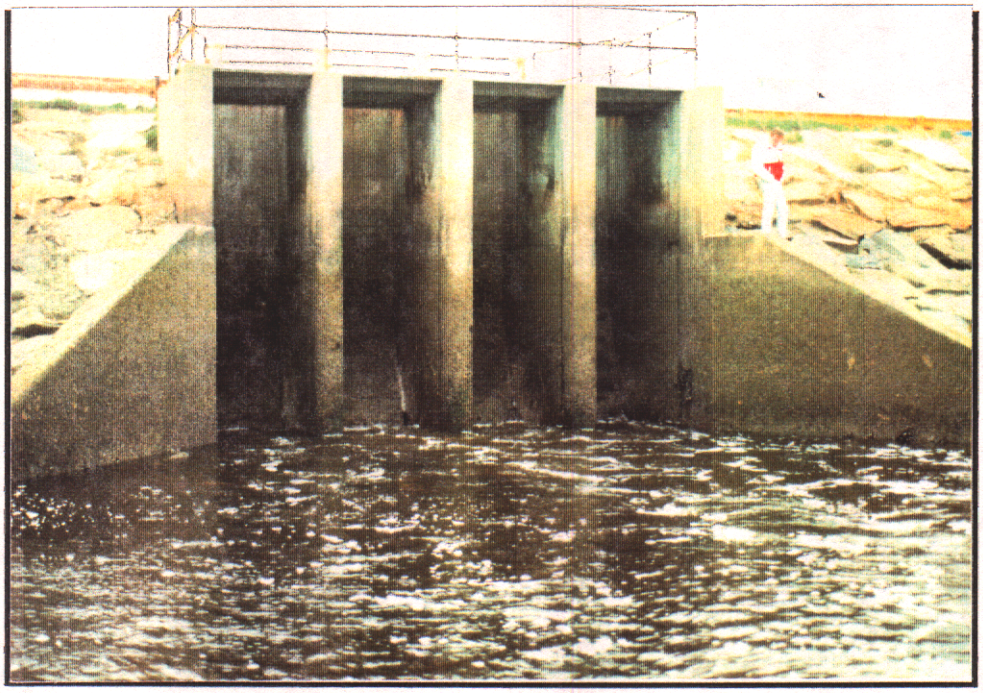


Figure 4A: Dike Road Tidegate Structure, View Looking upstream from Harbor side. Note: Four tide gates

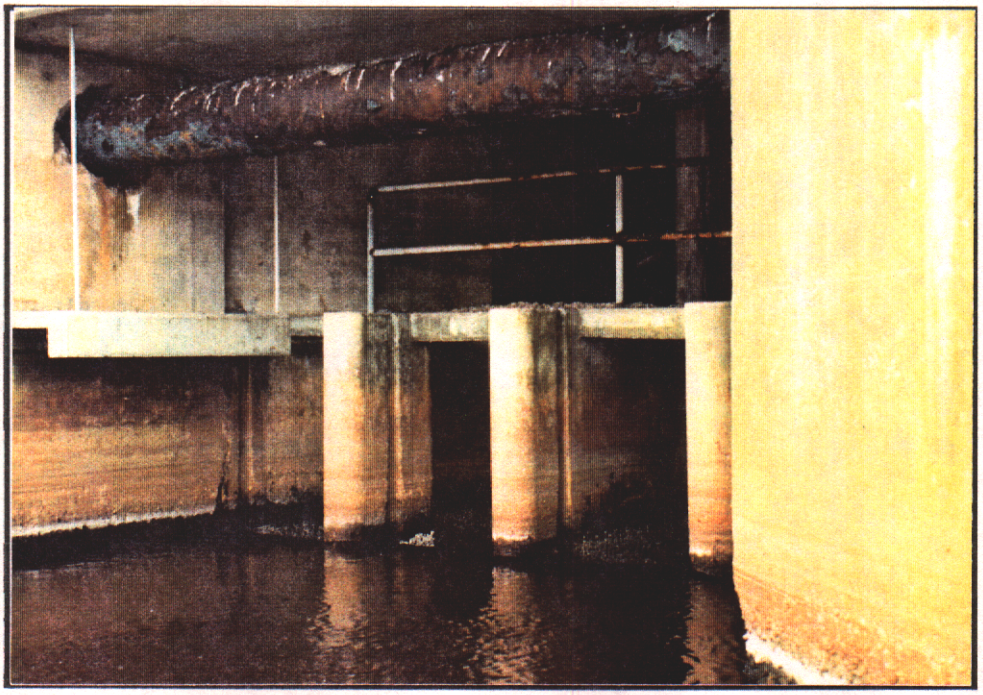
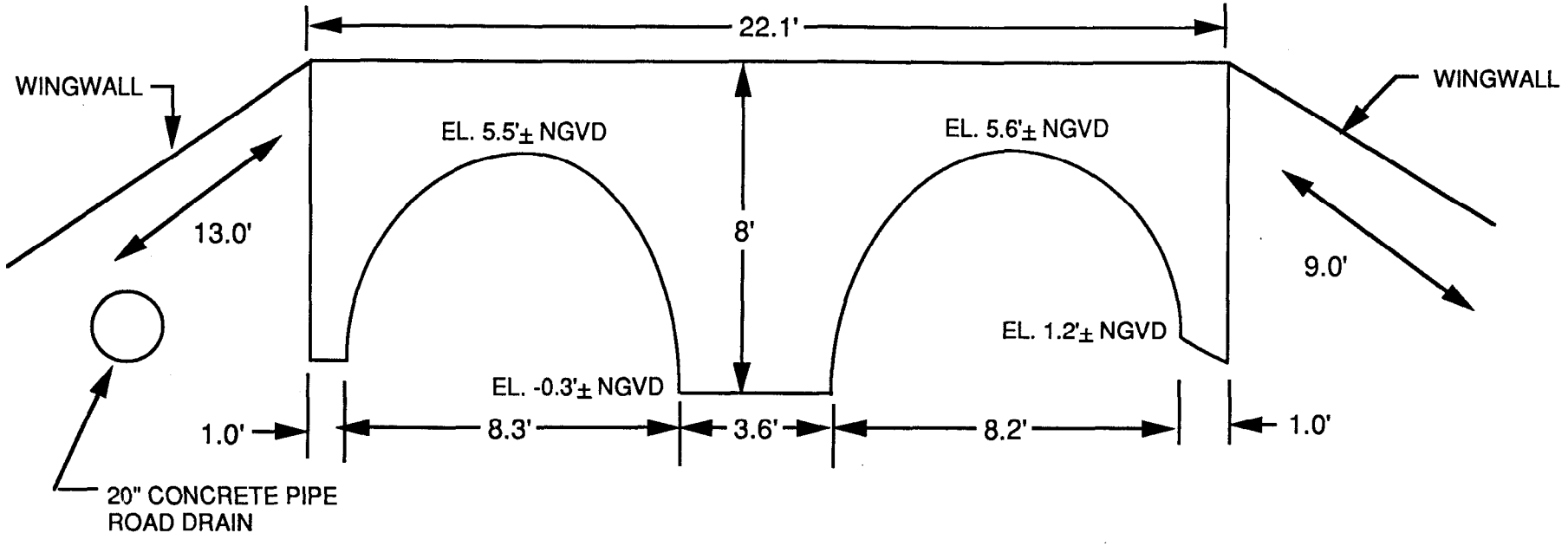


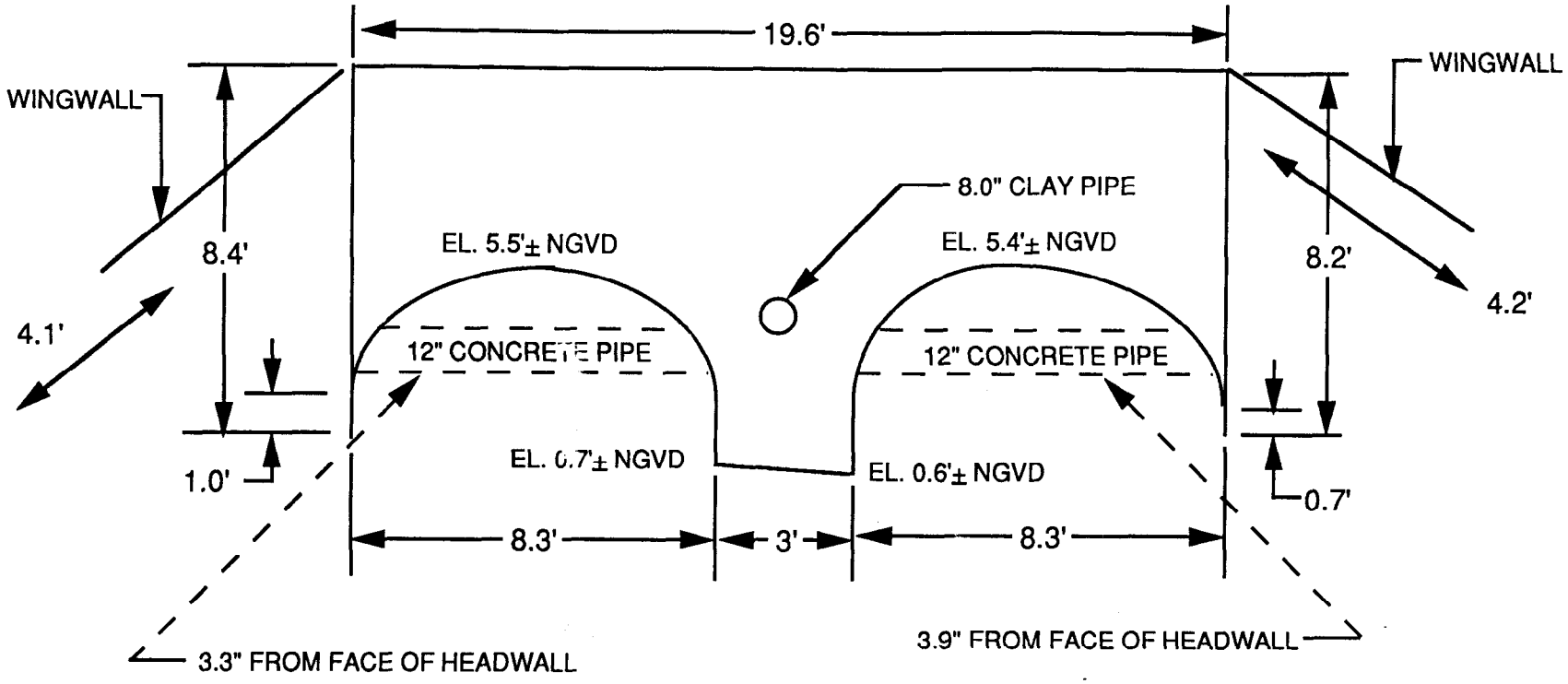
Figure 4B: Dike Road Tidegate Structure, View Looking Downstream from Marsh side. Note: Sluice board bays



WEBSTER STREET BRIDGE
VIEW LOOKING UPSTREAM

SCALE: 1"=4 FEET

FIGURE 5



WEBSTER STREET BRIDGE
VIEW LOOKING DOWNSTREAM

SCALE: 1"=4 FEET

FIGURE 6

Hydrologic and Hydraulic Appendix

COASTAL FLOODING IMPACT INVESTIGATION
HYDROLOGIC AND HYDRAULIC ANALYSIS
MARSHFIELD, MASSACHUSETTS

1. PURPOSE

This investigation was conducted to develop a preliminary evaluation of potential coastal flooding impacts associated with a proposal to open a series of tide gates near the mouth of Green Harbor River in Marshfield, Massachusetts. The gates presently restrict tidal flows to Green Harbor Marsh. This study was conducted under authority of the Corps of Engineers Flood Plain Management Program at the request of the Massachusetts Office of Coastal Zone Management.

2. BACKGROUND

Green Harbor Brook watershed originates in Duxbury, Massachusetts just east of State Highway Route 3 (see plate 1). Maximum watershed elevations approach 130 feet NGVD near North Duxbury. The brook begins at about elevation 50 feet NGVD and flows in a northerly direction passing through several small ponds, reservoirs, and cranberry bogs, finally reaching elevation 0 foot NGVD and becoming the Green Harbor River approximately 3 miles to the northeast near Webster Street in Marshfield. Total drainage area above Webster Street is about 3.3 square miles. Land use in Green Harbor Brook watershed is primarily wooded suburban residential along the uplands, with cranberry farms and evidence of some former gravel mining in the lowlands.

Downstream from Webster Street, Green Harbor River meanders through Green Harbor Marsh eventually reaching the bridge and tidegate structure at Dike Road (total drainage area of 7.2 square miles). The approximate 1,400-acre marsh includes several small ponds and tributaries, including Bass and Wharf Creeks. Development around the marsh is primarily mixed suburban residential and commercial including a golf course, cemetery, nature center, municipal airport, drive-in theater, and evidence of former gravel mining and farming operations. Developed areas appear to be located on fill generally at or above elevation 4 feet NGVD. Notable exceptions include the Sunrise Beach area where Plymouth Avenue, Mac Arthur Lane, and Johnson Terrace have minimum elevations of 3.5, 2.5, and 2.9 feet NGVD, respectively. In the Fieldston section, Constellation Road reaches 1.6 feet NGVD. The municipal airport has a spot level of 2.7 feet NGVD on one runway. The golf course and cranberry bogs near Webster Street have reported elevations as low as 3.8 and 3.5 feet NGVD, respectively.

Tidal flows are restricted from entering Green Harbor Marsh by four tide gates located on the downstream face of the bridge at Dike Road. During low tides, normal freshwater flows leaving the marsh are controlled by four sluice board bays located on the upstream side of Dike Road bridge. With the top of sluice boards at -3.7 feet NGVD, an essentially freshwater pond is maintained in the Green Harbor River upstream from the bridge. During high tides, ponding of coincident freshwater runoff occurs in Green Harbor Marsh until lower tides when the tidegates reopen. Dike Road bridge also contains another flow restriction, a 30-inch diameter sewer pipe, passing through the interior of the bridge at a fairly low level. Table 1 contains details of the bridge geometry.

Green Harbor River flows from the Webster Street cranberry bog area pass through the double arch bridge at Webster Street (see table 1). This structure appears to have a minimum channel elevation close to 0 foot NGVD. During high freshwater runoff periods coincident with high tides (when the Dike Road tide gates would be closed) it is expected that some ponding of freshwater runoff would occur extending upriver from Webster Street.

3. METHODOLOGY

Area-capacity relationships for the marsh between Dike Road and Webster Street and for the cranberry bog vicinity, upstream from Webster Street, were developed (see table 2). Two-foot contour interval maps at a scale of 1 inch equal 200 feet, prepared under direction of the Marshfield Board of Assessors by Avis Airmap, Inc., were used in this analysis. These were supplemented by the U.S. Geological Survey's Duxbury, MA, quadrangle map at a scale of 1:25,000 with 10-foot contour interval. At elevation 4 feet NGVD, the marsh has a gross storage capacity of about 2,800 acre-feet and a surface area of about 1,180 acres. By contrast, the area upstream from Webster Street has only about 43 acres and 49 acre feet of available storage volume at 4 feet NGVD.

Since the 7.2-square mile Green Harbor River watershed is ungaged, the nearby gaged Old Swamp River in Weymouth, Massachusetts, with a drainage area of 4.5 square miles, was used to estimate freshwater flows for this study. Based on drainage area ratios, an average annual flow of about 13 cfs was determined for Green Harbor River at Dike Road. This amounts to roughly 1 acre-foot of runoff per hour. Table 3 shows estimated peak flows and runoff volumes for 2, 10, 25 and 100 year frequency floods. Runoff volume is based on 12-hour rainfall from U.S. Weather Bureau's Technical Paper

TABLE 1
MARSHFIELD, MA - GREEN HARBOR RIVER
BRIDGE OPENING GEOMETRY

DIKE RD. BRIDGE

Downstream Face (Ocean)	Interior	Upstream Face (Marsh)
Top Control Slab: 11.11 ft., NGVD	Low Cord: 9 ft., NGVD +/- (Est.)	Top of Headwall: 12.4 ft., NGVD =/-
Top Apron Slab: -6.6 ft., NGVD	Invert: -6 ft., NGVD +/- (Est.)	Low Cord: 9 ft., NGVD +/-
Max. Clear Opening: 22.6 ft. (w)	Max. Clear Opening: Two spans @ 5.5 and 5.6 ft. (w) each	Top Apron Slab: -6 ft., NGVD
Piers: Three @ 1.2 to 1.0 ft. (w)	Pier: One @ 1.1 ft. (w)	Max. Clear Opening: 19.2 ft. (w)
Tidegates: Four @ 4.0 ft (w) x 5.4 ft (h)	Concrete Sewer Pipe: 30 in. dia. (est.)	Piers: Three @ 1.1 ft. (w)
Invert: -4.69 ft., NGVD	Top of Pipe: (est.) -1.2 ft., NGVD +/-	Access Walkway:
Soffit: 0.71 ft., NGVD	Bottom of Pipe: (est.) -3.7 ft., NGVD +/-	Top: (est.) 3.6 ft., NGVD +/-
		Low Cord: (est.) 2.8 ft., NGVD +/-
		Sluice Board Openings: Four @ 4.0, 3.9, 3.8, and 4.2 ft. (w)
		Top of Boards: -3.7 ft., NGVD
		Bottom of Boards: -6 ft., NGVD

TABLE 1 (con't)
MARSHFIELD, MA - GREEN HARBOR RIVER
BRIDGE OPENING GEOMETRY

WEBSTER ST. BRIDGE

Downstream Face
(Marsh)

Top Headwall:
7.72 ft., NGVD

Low Cord:
5.5 to 5.6 ft., NGVD +/-

Invert:
-0.3 to 1.2 ft., NGVD +/-

Opening:
Double Arch

Max. Width:
8.2 and 8.3 ft.

Max. Height:
5.0 and 6.0 ft.

Pier: One @
3.6 ft. (w)

Upstream Face
(Cranberry Bogs)

Top Headwall:
9.66 ft., NGVD

Low Cord:
5.4 to 5.5 ft., NGVD +/-

Invert:
0.5 to 1.5 ft., NGVD +/-

Opening:
Double Arch

Max. Width:
8.3 ft.

Max. Height:
4.8 and 5.0 ft.

Pier: One @
3.0 ft. (w)

Pipe:
12 in. dia. concrete

Top:
3.8 ft., NGVD +/-

Bottom:
2.8 ft., NGVD +/-

TABLE 2
MARSHFIELD, MA - GREEN HARBOR RIVER
AREA - CAPACITY RELATIONSHIP

Elevation (Ft, NGVD)	Dike Rd. Tidegate to Webster St.		Upstream from Webster St.	
	Area (Acres)	Volume (Ac-Ft)	Area (Acres)	Volume (Ac-Ft)
10	1,737	11,604	182	808
8	1,508	8,359	163	463
6	1,438	5,413	108	194
4	1,178	2,802	43	49
2	549	1,114	11	9
0.6	336	600	0	0
0	152	454		
-3.7	70	54		
-6	0	0		

TABLE 3
MARSHFIELD, MA - DIKE RD. BRIDGE
COINCIDENT FRESHWATER RUNOFF
(Total Drainage Area = 7.21 sq. mi.)

Flow event	Discharge (CFS)	Runoff Volume (Ac-Ft)
Avg. Annual	13	-
2-Yr.	300	115
10-Yr.	780	615
25-Yr.	1150	885
100-Yr.	1840	1345
SPF	-	4800 +/-

TABLE 4
MARSHFIELD, MA - DIKE RD. BRIDGE
SUMMARY OF TIDAL ROUTINGS
(All Four Tidegates Open, Sluice Boards Removed)

Location/ Condition	Tide		
	High (ft,NGVD)	Low (ft, NGVD)	Range (ft)
Ocean/ Max. Spring Tide	7.5	-7.2	14.7
Marsh/ Max. Spring Tide			
Avg. Annual Runoff	2.1	1.5	0.6
2-Yr. Runoff	2.3	1.5	0.8
10-Yr. Runoff	2.9	1.5	1.4
25-Yr. Runoff	3.2	1.5	1.7
100-Yr. Runoff	3.6	1.5	2.1
Ocean/ Mean Tide	5.0	-4.5	9.5
Marsh/ Mean Tide			
Avg. Annual Runoff	1.4	0.6	0.8
2-Yr. Runoff	1.6	0.6	1.0
10-Yr. Runoff	2.3	0.6	1.7
25-Yr. Runoff	2.6	0.6	2.0
100-Yr. Runoff	3.2	0.6	2.6

likely in the marsh coincident with average annual runoff. During flood flows, ponding in the marsh is estimated to range between approximate elevations 2.3 to 3.6 feet NGVD for 2-and 100-year floods, respectively. These ponding levels could be particularly troublesome to low lying developed areas previously described, having elevations in the 1.6 to 3.8 feet NGVD range. Presently, under the current mode of operation with the tide gates closed, there is 1,070 acre-feet of available storage between elevation 2 feet NGVD and the sluice boards at -3.7 feet NGVD. This could be a potential problem considering the fact that an estimated freshwater runoff of 885 and 1,345 acre-feet occurs for 25- and 100-year floods, respectively. This seems to indicate that flooding of some fringe development around the marsh may currently be a problem with a significant freshwater runoff event coincident with high tide. This situation may likely be worsened by fully opening all four tide gates.

5. SENSITIVITY

Using the previously developed discharge coefficients for the Dike Road bridge structure, a sensitivity analysis was conducted to look at the effect of fully opening 1, 2, 3, or 4 tide gates coincident with a spring tide and average annual runoff. High water levels in the marsh ranged from 1.3 feet NGVD with one gate opened to 2.1 feet NGVD with four gates opened, while fluctuations varied from 0.2 to 0.6 foot respectively (see table 5). Since there is only 360 acre-feet of storage in the marsh between 1.3 and 2.1 feet NGVD it does not appear possible to open any of the 4 tide gates without significantly increasing the threat of flooding. In addition, the current normal marsh ponding level is elevation -3.6 feet NGVD. With 1 gate opened, the <u>minimum</u> normal marsh water level for spring tide conditions will be about 1.1 feet NGVD. Comparing the elevation volume relationship at these elevations shows that there will be a loss of available storage for freshwater runoff of 700 acre-feet (1.8 inches of runoff). This lost volume is a significant amount of storage and will result in increasing interior flood levels. One possible alternative would be to examine the use of a self-regulating tide gate that would close at a predetermined water level so that a flood threat would not be increased. Another option would be to provide a larger gated opening at the bridge with a lower invert level, which would result in a larger interior tide range, greater interior drainage, and a lower minimum water level in the marsh. These evaluations are beyond the scope of the present study.

TABLE 5
MARSHFIELD, MA - DIKE RD. BRIDGE
SENSITIVITY OF TIDEGATE OPENINGS
(Max. Spring Tide - Avg. Annual Runoff)
(Sluice Boards Removed)

Location/ Gates	Tide		
	High (ft,NGVD)	Low (ft, NGVD)	Range (ft)
Ocean	7.5	-7.2	14.7
Marsh/			
1 Gate Open	1.3	1.1	0.2
2 Gates Open	1.8	1.4	0.4
3 Gates Open	2.0	1.5	0.5
4 Gates Open	2.1	1.5	0.6

TABLE 4 (con't)
MARSHFIELD, MA - DIKE RD. BRIDGE
SUMMARY OF TIDAL ROUTINGS
(All Four Tidegates Open, Sluice Boards Removed)

Location/ Condition	Tide		
	High (ft,NGVD)	Low (ft, NGVD)	Rang (ft)
Ocean/ Min. Neap Tide	2.7	-2.4	5.1
Marsh/ Min. Neap Tide			
Avg. Annual Runoff	0.9	0.2	0.7
2-Yr. Runoff	1.1	0.2	0.9
10-Yr. Runoff	1.7	0.2	1.5
25-Yr. Runoff	2.1	0.2	1.9
100-Yr. Runoff	2.7	0.2	2.5

6. CONCLUSIONS AND RECOMMENDATIONS

Based on this preliminary investigation, it does not appear that any tide gates under the Dike Road bridge can be fully opened without increasing the flood threat to low lying developments bordering the Green Harbor Marsh. It is recommended that additional study be conducted to thoroughly document all effects prior to implementing any such proposal, with the following to be considered:

a. The use of a self-regulating tide gate at Dike Road bridge may be possible to allow tidal flushing within a limited operating range of water levels without increasing the flood threat. The addition of a larger and lower opening at the bridge would likely result in greater tidal flushing and drainage in the marsh.

b. Effects of coastal storms with associated surge and wave height, runup, and overtopping should be evaluated.

c. The sewer pipe under Dike Road bridge is a major restriction to flow with the tide gates open. High velocities under the pipe (10 to 15 fps) could cause cavitation and extreme turbulence could rupture the pipe.

d. Presently, the pool upstream from the sluice boards is assumed to be essentially a freshwater pond. With tide gates open, it will become a saltwater or brackish waterbody. Due to limited flushing, water quality problems could result including anoxia, hydrogen sulfide production, and odor problems. This possibility should be further evaluated.

e. With a change to a brackish or saltwater pond, changes in plant and animal species are a certainty. These changes should be fully documented in a biological study. Effects on the saltwater mosquito population should be considered.

f. Saltwater intrusion into the cranberry bogs upstream from Webster Street is possible and may require construction of a tide gate at the Webster Street bridge.

g. Existing and projected flooding conditions at properties around the marsh should be fully documented prior to opening any tide gates or increasing opening size at Dike Road bridge.

h. A numerical hydrodynamic model of the marsh could be developed to refine estimated flood levels. A hydrologic storage routing, as completed for this study, tends to

produce worst case results in terms of the extent of flooding determined. Any modeling effort should be accompanied by a program of field data collection for water levels and flows.

i. Groundwater levels around the marsh could increase and should be evaluated as to effects on basements, crawl spaces, leaching fields, wells, etc.

APPENDIX A

SAMPLE HEC-2 OUTPUT

```
1*****************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.0;  February 1991        *
*                                         *
*  RUN DATE    07AUG92    TIME   17:19:49  *
*****************************************
```

```
*****************************************
*  U.S. ARMY CORPS OF ENGINEERS           *
*  HYDROLOGIC ENGINEERING CENTER          *
*  609 SECOND STREET, SUITE D             *
*  DAVIS, CALIFORNIA 95616-4687           *
*        (916) 756-1104                   *
*****************************************
```

ALL ELEVATIONS ARE NGVD + 100 FT.

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X           X     X
X     X  X        X                       X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
```

1

THIS RUN EXECUTED 07AUG92 17:19:50

```
*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.0;  February 1991
*************************************
```

```
T1      HEAD LOSS CALCULATIONS
T2      Q=100 CFS
T3      MARSHFIELS, MA DIKE RD

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
        0        2         0         0         0         0        .1         0     102.5         0

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
        1        0        -1         0         0         0         0         0         0         0

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

      150       100

J5  LPRNT     NUMSEC                    ********REQUESTED SECTION NUMBERS********

      -10       -10
```

```
NC      .06       .06       .03       .3        .5
QT        9       100       200       300       400       500       600       700       800       900
X1        1         8       755      1120         0         0         0         0       100         0
GR       10         0         2       250      -3.7       755        -6       970        -6      1030
GR     -3.7      1120         2      1530        10      2030

NC        0         0      .015         0         0         0         0         0         0         0
X1        2         4         0        60        80        80        80                 100
GR     12.4         0        -6        .1        -6      59.9      12.4        60

X1        3         4         0      19.2        12        12        12                 100
GR     12.4         0        -6        .1        -6      19.1      12.4      19.2

X1        4         0         0         0         7         7         7

X1        5        16         0      19.3        .1        .1        .1                 100
GR      9.1         0        -6        .1        -6         4       2.8       4.1       2.8       5.1
GR       -6       5.2        -6         9       2.8       9.1       2.8      10.1        -6      10.2
GR       -6        14       2.8      14.1       2.8      14.9        -6        15        -6      19.2
GR      9.1      19.3
1
     07AUG92     17:19:50                                                                          PAGE    2

X1      5.1         0         0         0       0.1       0.1       0.1
BT      -16         0     103.6     102.8        .1     103.6     102.8         4     103.6     102.8
BT                4.1     103.6     102.8       5.1     103.6     102.8       5.2     103.6     102.8
BT                  9     103.6     102.8       9.1     103.6     102.8      10.1     103.6     102.8
BT               10.2     103.6     102.8        14     103.6     102.8      14.1     103.6     102.8
BT               14.9     103.6     102.8        15     103.6     102.8      19.2     103.6     102.8
BT               19.3     103.6     102.8

X1        6         0         0         0       8.8       8.8       8.8
X2        0         0         0     102.8     103.6         0         1         0         0         0

X1        7         8         0      19.2        .1        .1        .1                 100
GR      9.1         0        -6        .1        -6         9       9.1       9.1       9.1      10.1
GR       -6      10.2        -6      19.1       9.1      19.2

X1        8         8         0      12.4       6.3       6.3       6.3                 100
GR      9.1         0        -6        .1        -6       5.5       9.1       5.6       9.1       6.6
GR       -6       6.7        -6      12.3       9.1      12.4

X1        9         0         0         0         2         2         2

X1       10         0         0         0        .1        .1        .1

SB     1.25       1.6       3.2      11.1      12.2       1.1      25.5
X1       11         0         0         0       2.5       2.5       2.5
X2        0         0         1      96.3      98.8

X1       12         0         0         0        .1        .1        .1

X1       13         0         0         0        55        55        55
```

```
X1       14         4         0      22.6         6         6         6                    100
GR      8.1         0      -6.0        .1      -6.0      22.5       8.1      22.6
SB      1.25       1.6       3.2         0      22.6       6.6      86.4         0      95.3      95.3
X1        15         0         0         0      12.1      12.1      12.1         0      -0.6         0
X2         0         0         1     100.7     111.1
X1        16         4         0        40        20        20        20                    100
GR        11         0      -6.6        .1      -6.6      39.9        11        40
NC       .06       .06       .03        .3        .5
X1        17         6       650      1220        80        80        80                    100
GR        10         0         2       650        -7       900        -7      1000         2      1220
GR        10      1680
1
   07AUG92      17:19:50                                                                  PAGE    3

T1      HEAD LOSS COMPUTATIONS
T2      Q=200 CFS
T3      MARSHFIELD, MA DIKE RD

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
        0       3          0         0         0         0        .1         0     102.5          0
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
        2       0         -1         0         0         0         0         0         0         0
1
   07AUG92      17:19:50                                                                  PAGE    4

T1      HEAD LOSS COMPUTATIONS
T2      Q=300 CFS
T3      MARSHFIELD, MA DIKE RD

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
        0       4          0         0         0         0        .1         0     102.5          0
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
        3       0         -1         0         0         0         0         0         0         0
1
   07AUG92      17:19:50                                                                  PAGE    5

T1      HEAD LOSS COMPUTATIONS
T2      Q=400 CFS
T3      MARSHFIELD, MA DIKE RD

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
```

	0	5	0	0	0	0	.1	0	102.5	0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	4	0	-1	0	0	0	0	0	0	0

1
07AUG92 17:19:50 PAGE 6

T1 HEAD LOSS COMPUTATIONS
T2 Q=500 CFS
T3 MARSHFIELD, MA DIKE RD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	6	0	0	0	0	.1	0	102.5	0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	5	0	-1	0	0	0	0	0	0	0

1
07AUG92 17:19:50 PAGE 7

T1 HEAD LOSS COMPUTATIONS
T2 Q=600 CFS
T3 MARSHFIELD, MA DIKE RD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	7	0	0	0	0	.1	0	102.5	0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	6	0	-1	0	0	0	0	0	0	0

1
07AUG92 17:19:50 PAGE 8

T1 HEAD LOSS COMPUTATIONS
T2 Q=700 CFS
T3 MARSHFIELD, MA DIKE RD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	8	0	0	0	0	.1	0	102.5	0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	7	0	-1	0	0	0	0	0	0	0

1
07AUG92 17:19:50 PAGE 9

T1 HEAD LOSS COMPUTATIONS
T2 Q=800 CFS
T3 MARSHFIELD, MA DIKE RD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	9	0	0	0	0	.1	0	102.5	0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	8	0	-1	0	0	0	0	0	0	0

1
07AUG92 17:19:50 PAGE 10

T1 HEAD LOSS COMPUTATIONS
T2 Q=900 CFS
T3 MARSHFIELD, MA DIKE RD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	10	0	0	0	0	.1	0	102.5	0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	9	0	-1	0	0	0	0	0	0	0

1
07AUG92 17:19:50 PAGE 11

THIS RUN EXECUTED 07AUG92 17:20:48

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.0; February 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

MARSHFIELS, MA DIKE RD

SUMMARY PRINTOUT TABLE 100

SECNO	EGLWC	ELLC	EGPRS	ELTRD	QPR	QWEIR	CLASS	H3	DEPTH	CWSEL	VCH	EG
11.000	102.51	96.30	102.88	98.80	21.29	78.96	30.00	.00	8.49	102.49	1.06	102.51
11.000	102.55	96.30	104.00	98.80	46.85	153.05	30.00	.01	8.49	102.49	2.12	102.56

11.000	102.63	96.30	105.88	98.80	78.63	222.86	30.00	.03	8.52	102.52	3.17	102.67
11.000	102.74	96.30	108.50	98.80	116.64	285.08	30.00	.06	8.64	102.64	4.17	102.91
11.000	102.90	96.30	111.87	98.80	159.95	337.63	30.00	.12	8.90	102.90	5.05	103.30
11.000	103.13	96.30	116.00	98.80	203.67	400.14	30.00	.22	9.30	103.30	5.80	103.83
11.000	103.45	96.30	120.86	98.80	239.03	460.99	30.00	.38	9.67	103.67	6.51	104.32
11.000	103.90	96.30	126.47	98.80	272.13	528.25	30.00	.63	10.06	104.06	7.14	104.85
11.000	104.55	96.30	132.82	98.80	302.73	598.66	30.00	1.03	10.44	104.44	7.74	105.37
15.000	102.52	100.70	102.55	111.10	100.00	.00	10.00	.00	9.14	102.54	.49	102.55
15.000	102.59	100.70	102.70	111.10	200.00	.00	10.00	.01	9.28	102.68	.96	102.70
15.000	102.75	100.70	102.99	111.10	300.00	.00	10.00	.03	9.56	102.96	1.40	102.99
15.000	103.04	100.70	103.48	111.10	400.00	.00	10.00	.05	10.03	103.43	1.77	103.48
15.000	103.50	100.70	104.19	111.10	500.00	.00	10.00	.07	10.72	104.12	2.07	104.19
15.000	104.09	100.70	105.10	111.10	600.00	.00	10.00	.09	11.62	105.02	2.30	105.10
15.000	104.66	100.70	106.06	111.10	700.00	.00	10.00	.11	12.56	105.96	2.48	106.06
15.000	105.25	100.70	107.11	111.10	800.00	.00	10.00	.13	13.60	107.00	2.61	107.11
15.000	105.85	100.70	108.22	111.10	900.00	.00	10.00	.16	14.71	108.11	2.72	108.22

1

MARSHFIELS, MA DIKE RD

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	94.00	100.00	102.50	.00	102.50	.00	.03	5828.72	6941.38
	1.000	.00	.00	.00	94.00	200.00	102.50	.00	102.50	.00	.05	5828.72	6941.38
	1.000	.00	.00	.00	94.00	300.00	102.50	.00	102.50	.00	.08	5828.72	6941.38
	1.000	.00	.00	.00	94.00	400.00	102.50	.00	102.50	.00	.11	5828.72	6941.38
	1.000	.00	.00	.00	94.00	500.00	102.50	.00	102.50	.01	.14	5828.72	6941.38
	1.000	.00	.00	.00	94.00	600.00	102.50	.00	102.50	.01	.16	5828.72	6941.38
	1.000	.00	.00	.00	94.00	700.00	102.50	.00	102.50	.01	.19	5828.72	6941.38
	1.000	.00	.00	.00	94.00	800.00	102.50	.00	102.50	.01	.22	5828.72	6941.38
	1.000	.00	.00	.00	94.00	900.00	102.50	.00	102.50	.02	.25	5828.72	6941.38
*	2.000	80.00	.00	.00	94.00	100.00	102.50	.00	102.50	.00	.20	508.69	1777.48
*	2.000	80.00	.00	.00	94.00	200.00	102.50	.00	102.50	.01	.39	508.69	1777.48
*	2.000	80.00	.00	.00	94.00	300.00	102.50	.00	102.50	.03	.59	508.69	1777.48
*	2.000	80.00	.00	.00	94.00	400.00	102.50	.00	102.50	.05	.79	508.69	1777.48
*	2.000	80.00	.00	.00	94.00	500.00	102.49	.00	102.51	.08	.98	508.69	1777.48
*	2.000	80.00	.00	.00	94.00	600.00	102.49	.00	102.51	.11	1.18	508.38	1775.82
*	2.000	80.00	.00	.00	94.00	700.00	102.49	.00	102.52	.16	1.38	508.27	1775.21
*	2.000	80.00	.00	.00	94.00	800.00	102.48	.00	102.52	.20	1.57	508.13	1774.52
*	2.000	80.00	.00	.00	94.00	900.00	102.48	.00	102.53	.26	1.77	507.27	1769.94
*	3.000	12.00	.00	.00	94.00	100.00	102.50	.00	102.50	.05	.62	161.89	436.96
*	3.000	12.00	.00	.00	94.00	200.00	102.49	.00	102.51	.21	1.24	161.77	436.53
*	3.000	12.00	.00	.00	94.00	300.00	102.47	.00	102.53	.48	1.86	161.38	435.12
*	3.000	12.00	.00	.00	94.00	400.00	102.45	.00	102.55	.85	2.48	160.98	433.66
*	3.000	12.00	.00	.00	94.00	500.00	102.43	.00	102.58	1.34	3.12	160.46	431.76
*	3.000	12.00	.00	.00	94.00	600.00	102.39	.00	102.61	1.95	3.75	159.82	429.41
*	3.000	12.00	.00	.00	94.00	700.00	102.35	.00	102.65	2.69	4.40	159.04	426.58

*	3.000	12.00	.00	.00	94.00	800.00	102.30	.00	102.70	3.57	5.06	158.12	423.25
*	3.000	12.00	.00	.00	94.00	900.00	102.25	.00	102.76	4.61	5.73	157.06	419.39
	4.000	7.00	.00	.00	94.00	100.00	102.50	.00	102.50	.05	.62	161.84	436.77
	4.000	7.00	.00	.00	94.00	200.00	102.49	.00	102.51	.21	1.24	161.67	436.15
	4.000	7.00	.00	.00	94.00	300.00	102.47	.00	102.53	.48	1.86	161.38	435.12
	4.000	7.00	.00	.00	94.00	400.00	102.45	.00	102.55	.85	2.48	160.98	433.66
	4.000	7.00	.00	.00	94.00	500.00	102.43	.00	102.58	1.34	3.12	160.46	431.76
	4.000	7.00	.00	.00	94.00	600.00	102.39	.00	102.61	1.95	3.75	159.82	429.41
	4.000	7.00	.00	.00	94.00	700.00	102.35	.00	102.65	2.69	4.40	159.04	426.58
	4.000	7.00	.00	.00	94.00	800.00	102.30	.00	102.70	3.57	5.06	158.12	423.25
	4.000	7.00	.00	.00	94.00	900.00	102.25	.00	102.76	4.61	5.73	157.05	419.37

1

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	5.000	.10	.00	.00	94.00	100.00	102.50	.00	102.50	.29	.73	136.34	187.03
*	5.000	.10	.00	.00	94.00	200.00	102.48	.00	102.52	1.15	1.47	136.20	186.81
*	5.000	.10	.00	.00	94.00	300.00	102.46	.00	102.54	2.59	2.21	135.87	186.29
*	5.000	.10	.00	.00	94.00	400.00	102.43	.00	102.57	4.64	2.95	135.46	185.65
*	5.000	.10	.00	.00	94.00	500.00	102.39	.00	102.61	7.35	3.71	134.66	184.41
*	5.000	.10	.00	.00	94.00	600.00	102.35	.00	102.66	10.73	4.48	133.87	183.18
*	5.000	.10	.00	.00	94.00	700.00	102.29	.00	102.72	14.84	5.27	132.91	181.68
*	5.000	.10	.00	.00	94.00	800.00	102.22	.00	102.79	19.77	6.07	131.77	179.90
*	5.000	.10	.00	.00	94.00	900.00	102.14	.00	102.87	25.62	6.90	130.42	177.80
	5.100	.10	103.60	102.80	94.00	100.00	102.50	.00	102.50	.29	.73	136.32	187.00
	5.100	.10	103.60	102.80	94.00	200.00	102.48	.00	102.52	1.15	1.47	136.12	186.68
	5.100	.10	103.60	102.80	94.00	300.00	102.46	.00	102.54	2.60	2.21	135.78	186.15
	5.100	.10	103.60	102.80	94.00	400.00	102.43	.00	102.57	4.65	2.96	135.30	185.40
	5.100	.10	103.60	102.80	94.00	500.00	102.39	.00	102.61	7.35	3.71	134.66	184.41
	5.100	.10	103.60	102.80	94.00	600.00	102.35	.00	102.66	10.73	4.48	133.87	183.18
	5.100	.10	103.60	102.80	94.00	700.00	102.29	.00	102.72	14.84	5.27	132.91	181.68
	5.100	.10	103.60	102.80	94.00	800.00	102.22	.00	102.79	19.78	6.07	131.77	179.90
	5.100	.10	103.60	102.80	94.00	900.00	102.14	.00	102.87	25.62	6.90	130.42	177.80
	6.000	8.80	103.60	102.80	94.00	100.00	102.50	.00	102.50	.29	.73	136.32	187.00
	6.000	8.80	103.60	102.80	94.00	200.00	102.48	.00	102.52	1.15	1.47	136.12	186.68
	6.000	8.80	103.60	102.80	94.00	300.00	102.46	.00	102.54	2.60	2.21	135.78	186.15
	6.000	8.80	103.60	102.80	94.00	400.00	102.44	.00	102.57	4.66	2.96	135.29	185.40
	6.000	8.80	103.60	102.80	94.00	500.00	102.40	.00	102.62	7.35	3.71	134.66	184.41
	6.000	8.80	103.60	102.80	94.00	600.00	102.36	.00	102.67	10.73	4.48	133.87	183.18
	6.000	8.80	103.60	102.80	94.00	700.00	102.30	.00	102.73	14.82	5.26	133.02	181.85
	6.000	8.80	103.60	102.80	94.00	800.00	102.24	.00	102.81	19.66	6.06	132.12	180.45
	6.000	8.80	103.60	102.80	94.00	900.00	102.16	.00	102.90	25.40	6.88	130.90	178.56
*	7.000	.10	.00	.00	94.00	100.00	102.50	.00	102.50	.10	.66	152.19	309.34
*	7.000	.10	.00	.00	94.00	200.00	102.49	.00	102.52	.42	1.32	151.98	308.81
*	7.000	.10	.00	.00	94.00	300.00	102.48	.00	102.55	.95	1.98	151.80	308.37
*	7.000	.10	.00	.00	94.00	400.00	102.47	.00	102.58	1.68	2.64	151.78	308.32
*	7.000	.10	.00	.00	94.00	500.00	102.46	.00	102.63	2.64	3.30	151.53	307.69
*	7.000	.10	.00	.00	94.00	600.00	102.44	.00	102.69	3.82	3.97	151.24	306.97
*	7.000	.10	.00	.00	94.00	700.00	102.43	.00	102.76	5.23	4.64	150.94	306.21

*	7.000	.10	.00	.00	94.00	800.00	102.41	.00	102.85	6.86	5.31	150.64	305.48
*	7.000	.10	.00	.00	94.00	900.00	102.40	.00	102.95	8.71	5.98	150.41	304.90
*	8.000	6.30	.00	.00	94.00	100.00	102.49	.00	102.51	.43	1.06	94.44	153.37
*	8.000	6.30	.00	.00	94.00	200.00	102.47	.00	102.54	1.71	2.12	94.14	152.81
*	8.000	6.30	.00	.00	94.00	300.00	102.44	.00	102.60	3.89	3.20	93.74	152.06
*	8.000	6.30	.00	.00	94.00	400.00	102.39	.00	102.67	7.02	4.29	93.18	150.99
*	8.000	6.30	.00	.00	94.00	500.00	102.32	.00	102.77	11.17	5.41	92.44	149.58
*	8.000	6.30	.00	.00	94.00	600.00	102.24	.00	102.90	16.48	6.56	91.50	147.81
*	8.000	6.30	.00	.00	94.00	700.00	102.13	.00	103.07	23.10	7.75	90.36	145.64
*	8.000	6.30	.00	.00	94.00	800.00	102.01	.00	103.26	31.28	8.99	88.98	143.04
*	8.000	6.30	.00	.00	94.00	900.00	101.86	.00	103.51	41.35	10.30	87.35	139.96

1

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
9.000	2.00	.00	.00	94.00	100.00	102.49	.00	102.51	.43	1.06	94.38	153.26
9.000	2.00	.00	.00	94.00	200.00	102.47	.00	102.54	1.71	2.12	94.14	152.81
9.000	2.00	.00	.00	94.00	300.00	102.44	.00	102.60	3.89	3.20	93.74	152.06
9.000	2.00	.00	.00	94.00	400.00	102.39	.00	102.67	7.02	4.29	93.18	150.99
9.000	2.00	.00	.00	94.00	500.00	102.32	.00	102.78	11.17	5.41	92.44	149.58
9.000	2.00	.00	.00	94.00	600.00	102.24	.00	102.91	16.48	6.56	91.50	147.80
9.000	2.00	.00	.00	94.00	700.00	102.14	.00	103.07	23.11	7.75	90.35	145.62
9.000	2.00	.00	.00	94.00	800.00	102.02	.00	103.27	31.30	8.99	88.95	142.99
9.000	2.00	.00	.00	94.00	900.00	101.87	.00	103.52	41.42	10.31	87.29	139.84
10.000	.10	.00	.00	94.00	100.00	102.49	.00	102.51	.43	1.06	94.38	153.26
10.000	.10	.00	.00	94.00	200.00	102.47	.00	102.54	1.71	2.12	94.15	152.82
10.000	.10	.00	.00	94.00	300.00	102.44	.00	102.60	3.89	3.20	93.75	152.07
10.000	.10	.00	.00	94.00	400.00	102.39	.00	102.67	7.02	4.29	93.20	151.02
10.000	.10	.00	.00	94.00	500.00	102.32	.00	102.78	11.17	5.41	92.46	149.62
10.000	.10	.00	.00	94.00	600.00	102.24	.00	102.91	16.46	6.55	91.53	147.87
10.000	.10	.00	.00	94.00	700.00	102.14	.00	103.07	23.08	7.74	90.40	145.72
10.000	.10	.00	.00	94.00	800.00	102.02	.00	103.27	31.25	8.99	89.02	143.11
10.000	.10	.00	.00	94.00	900.00	101.87	.00	103.52	41.33	10.30	87.36	139.99
11.000	2.50	98.80	96.30	94.00	100.00	102.49	.00	102.51	.42	1.06	94.48	153.45
11.000	2.50	98.80	96.30	94.00	200.00	102.49	.00	102.56	1.71	2.12	94.30	153.12
11.000	2.50	98.80	96.30	94.00	300.00	102.52	.00	102.67	3.81	3.17	94.66	153.79
11.000	2.50	98.80	96.30	94.00	400.00	102.64	.00	102.91	6.54	4.17	96.01	156.36
11.000	2.50	98.80	96.30	94.00	500.00	102.90	.00	103.30	9.52	5.05	99.01	162.05
11.000	2.50	98.80	96.30	94.00	600.00	103.30	.00	103.83	12.36	5.80	103.51	170.64
11.000	2.50	98.80	96.30	94.00	700.00	103.67	.00	104.32	15.38	6.51	107.61	178.47
11.000	2.50	98.80	96.30	94.00	800.00	104.06	.00	104.85	18.31	7.14	112.03	186.94
11.000	2.50	98.80	96.30	94.00	900.00	104.44	.00	105.37	21.26	7.74	116.33	195.20
12.000	.10	.00	.00	94.00	100.00	102.49	.00	102.51	.43	1.06	94.38	153.26
12.000	.10	.00	.00	94.00	200.00	102.49	.00	102.56	1.71	2.12	94.30	153.12
12.000	.10	.00	.00	94.00	300.00	102.52	.00	102.67	3.81	3.17	94.66	153.78
12.000	.10	.00	.00	94.00	400.00	102.64	.00	102.91	6.55	4.17	96.01	156.35
12.000	.10	.00	.00	94.00	500.00	102.90	.00	103.30	9.52	5.05	98.99	162.03
12.000	.10	.00	.00	94.00	600.00	103.30	.00	103.83	12.37	5.80	103.49	170.59
12.000	.10	.00	.00	94.00	700.00	103.67	.00	104.32	15.40	6.51	107.56	178.37

12.000	.10	.00	.00	94.00	800.00	104.06	.00	104.85	18.34	7.15	111.95	186.79
12.000	.10	.00	.00	94.00	900.00	104.44	.00	105.37	21.26	7.74	116.33	195.20
13.000	55.00	.00	.00	94.00	100.00	102.50	.00	102.51	.43	1.06	94.38	153.26
13.000	55.00	.00	.00	94.00	200.00	102.50	.00	102.57	1.71	2.12	94.30	153.12
13.000	55.00	.00	.00	94.00	300.00	102.54	.00	102.69	3.78	3.16	94.90	154.25
13.000	55.00	.00	.00	94.00	400.00	102.68	.00	102.94	6.48	4.15	96.45	157.18
13.000	55.00	.00	.00	94.00	500.00	102.96	.00	103.35	9.38	5.02	99.66	163.29
13.000	55.00	.00	.00	94.00	600.00	103.38	.00	103.90	12.13	5.75	104.37	172.28
13.000	55.00	.00	.00	94.00	700.00	103.77	.00	104.41	15.03	6.44	108.70	180.56
13.000	55.00	.00	.00	94.00	800.00	104.18	.00	104.95	17.83	7.06	113.36	189.48
13.000	55.00	.00	.00	94.00	900.00	104.59	.00	105.50	20.57	7.63	118.02	198.45

1

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	14.000	6.00	.00	.00	94.00	100.00	102.51	.00	102.52	.03	.52	191.00	541.95
*	14.000	6.00	.00	.00	94.00	200.00	102.56	.00	102.58	.13	1.04	192.37	547.32
*	14.000	6.00	.00	.00	94.00	300.00	102.69	.00	102.73	.29	1.54	195.28	558.76
*	14.000	6.00	.00	.00	94.00	400.00	102.95	.00	103.01	.47	1.99	200.94	581.11
*	14.000	6.00	.00	.00	94.00	500.00	103.36	.00	103.45	.65	2.38	210.24	618.22
*	14.000	6.00	.00	.00	94.00	600.00	103.90	.00	104.02	.81	2.70	222.56	667.97
*	14.000	6.00	.00	.00	94.00	700.00	104.43	.00	104.56	.96	2.99	234.33	716.11
*	14.000	6.00	.00	.00	94.00	800.00	104.98	.00	105.14	1.09	3.24	246.74	767.48
*	14.000	6.00	.00	.00	94.00	900.00	105.53	.00	105.71	1.21	3.47	259.20	819.57
	15.000	12.10	111.10	100.70	93.40	100.00	102.54	.00	102.55	.03	.49	205.46	599.10
	15.000	12.10	111.10	100.70	93.40	200.00	102.68	.00	102.70	.11	.96	208.73	612.15
	15.000	12.10	111.10	100.70	93.40	300.00	102.96	.00	102.99	.22	1.40	214.87	636.82
	15.000	12.10	111.10	100.70	93.40	400.00	103.43	.00	103.48	.35	1.77	225.35	679.35
	15.000	12.10	111.10	100.70	93.40	500.00	104.12	.00	104.19	.45	2.07	241.01	743.69
	15.000	12.10	111.10	100.70	93.40	600.00	105.02	.00	105.10	.52	2.30	261.25	828.22
	15.000	12.10	111.10	100.70	93.40	700.00	105.96	.00	106.06	.58	2.48	282.48	918.35
	15.000	12.10	111.10	100.70	93.40	800.00	107.00	.00	107.11	.62	2.61	305.93	1019.39
	15.000	12.10	111.10	100.70	93.40	900.00	108.11	.00	108.22	.64	2.72	330.97	1128.85
*	16.000	20.00	.00	.00	93.40	100.00	102.55	.00	102.55	.01	.27	364.34	1227.68
*	16.000	20.00	.00	.00	93.40	200.00	102.70	.00	102.70	.03	.54	370.24	1256.74
*	16.000	20.00	.00	.00	93.40	300.00	102.99	.00	103.00	.05	.78	382.22	1316.26
*	16.000	20.00	.00	.00	93.40	400.00	103.47	.00	103.49	.08	1.00	401.46	1413.16
*	16.000	20.00	.00	.00	93.40	500.00	104.18	.00	104.20	.10	1.16	429.82	1558.90
*	16.000	20.00	.00	.00	93.40	600.00	105.09	.00	105.12	.12	1.29	466.19	1750.38
*	16.000	20.00	.00	.00	93.40	700.00	106.05	.00	106.08	.13	1.39	504.23	1955.79
*	16.000	20.00	.00	.00	93.40	800.00	107.09	.00	107.13	.13	1.46	546.09	2187.11
*	16.000	20.00	.00	.00	93.40	900.00	108.21	.00	108.25	.14	1.52	590.69	2439.11
*	17.000	80.00	.00	.00	93.00	100.00	102.55	.00	102.55	.00	.03	3347.58	5342.24
*	17.000	80.00	.00	.00	93.00	200.00	102.70	.00	102.70	.00	.06	3449.60	5583.27
*	17.000	80.00	.00	.00	93.00	300.00	103.00	.00	103.00	.00	.08	3656.38	6063.93
*	17.000	80.00	.00	.00	93.00	400.00	103.49	.00	103.49	.00	.10	4020.19	6889.65
*	17.000	80.00	.00	.00	93.00	500.00	104.21	.00	104.21	.00	.12	4613.63	8199.70
*	17.000	80.00	.00	.00	93.00	600.00	105.13	.00	105.13	.00	.12	5475.67	10055.18
*	17.000	80.00	.00	.00	93.00	700.00	106.09	.00	106.09	.00	.13	6501.20	12225.31

*	17.000	80.00	.00	.00	93.00	800.00	107.14	.00	107.14	.00	.13	7774.11	14896.11
*	17.000	80.00	.00	.00	93.00	900.00	108.26	.00	108.26	.00	.13	9297.17	18086.82

1

MARSHFIELS, MA DIKE RD

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	100.00	102.50	.00	.00	.00	1326.88	.00
	1.000	200.00	102.50	.00	.00	.00	1326.88	.00
	1.000	300.00	102.50	.00	.00	.00	1326.88	.00
	1.000	400.00	102.50	.00	.00	.00	1326.88	.00
	1.000	500.00	102.50	.00	.00	.00	1326.88	.00
	1.000	600.00	102.50	.00	.00	.00	1326.88	.00
	1.000	700.00	102.50	.00	.00	.00	1326.88	.00
	1.000	800.00	102.50	.00	.00	.00	1326.88	.00
	1.000	900.00	102.50	.00	.00	.00	1326.88	.00
*	2.000	100.00	102.50	.00	.00	.00	59.89	80.00
*	2.000	200.00	102.50	.00	.00	.00	59.89	80.00
*	2.000	300.00	102.50	.00	.00	.00	59.89	80.00
*	2.000	400.00	102.50	.00	.00	.00	59.89	80.00
*	2.000	500.00	102.49	.00	-.01	.00	59.89	80.00
*	2.000	600.00	102.49	.00	-.01	.00	59.89	80.00
*	2.000	700.00	102.49	.00	-.01	.00	59.89	80.00
*	2.000	800.00	102.48	.00	-.02	.00	59.89	80.00
*	2.000	900.00	102.48	-.01	-.02	.00	59.89	80.00
*	3.000	100.00	102.50	.00	.00	.00	19.09	12.00
*	3.000	200.00	102.49	-.01	-.01	.00	19.09	12.00
*	3.000	300.00	102.47	-.01	-.02	.00	19.09	12.00
*	3.000	400.00	102.45	-.02	-.04	.00	19.09	12.00
*	3.000	500.00	102.43	-.03	-.07	.00	19.09	12.00
*	3.000	600.00	102.39	-.03	-.10	.00	19.09	12.00
*	3.000	700.00	102.35	-.04	-.14	.00	19.09	12.00
*	3.000	800.00	102.30	-.05	-.18	.00	19.09	12.00
*	3.000	900.00	102.25	-.06	-.23	.00	19.09	12.00
	4.000	100.00	102.50	.00	.00	.00	19.09	7.00
	4.000	200.00	102.49	-.01	.00	.00	19.09	7.00
	4.000	300.00	102.47	-.01	.00	.00	19.09	7.00
	4.000	400.00	102.45	-.02	.00	.00	19.09	7.00
	4.000	500.00	102.43	-.03	.00	.00	19.09	7.00
	4.000	600.00	102.39	-.03	.00	.00	19.09	7.00
	4.000	700.00	102.35	-.04	.00	.00	19.09	7.00
	4.000	800.00	102.30	-.05	.00	.00	19.09	7.00
	4.000	900.00	102.25	-.06	.00	.00	19.09	7.00

1

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
9.000	100.00	102.49	.00	.00	.00	11.22	2.00
9.000	200.00	102.47	-.02	.00	.00	11.22	2.00
9.000	300.00	102.44	-.04	.00	.00	11.22	2.00
9.000	400.00	102.39	-.05	.00	.00	11.22	2.00
9.000	500.00	102.32	-.07	.00	.00	11.22	2.00
9.000	600.00	102.24	-.08	.00	.00	11.22	2.00
9.000	700.00	102.14	-.10	.00	.00	11.22	2.00
9.000	800.00	102.02	-.12	.01	.00	11.21	2.00
9.000	900.00	101.87	-.15	.01	.00	11.21	2.00
10.000	100.00	102.49	.00	.00	.00	11.22	.10
10.000	200.00	102.47	-.02	.00	.00	11.22	.10
10.000	300.00	102.44	-.03	.00	.00	11.22	.10
10.000	400.00	102.39	-.05	.00	.00	11.22	.10
10.000	500.00	102.32	-.07	.00	.00	11.22	.10
10.000	600.00	102.24	-.08	.00	.00	11.22	.10
10.000	700.00	102.14	-.10	.00	.00	11.22	.10
10.000	800.00	102.02	-.12	.00	.00	11.21	.10
10.000	900.00	101.87	-.15	.00	.00	11.21	.10
11.000	100.00	102.49	.00	.00	00	11.23	2.50
11.000	200.00	102.49	-.01	.01	00	11.22	2.50
11.000	300.00	102.52	.03	.08	.00	11.23	2.50
11.000	400.00	102.64	.12	.25	.00	11.23	2.50
11.000	500.00	102.90	.27	.58	.00	11.24	2.50
11.000	600.00	103.30	.40	1.06	.00	11.25	2.50
11.000	700.00	103.67	.36	1.53	.00	11.26	2.50
11.000	800.00	104.06	.39	2.04	.00	11.27	2.50
11.000	900.00	104.44	.39	2.57	.00	11.28	2.50
12.000	100.00	102.49	.00	.00	.00	11.22	.10
12.000	200.00	102.49	-.01	.00	.00	11.22	.10
12.000	300.00	102.52	.03	.00	.00	11.23	.10
12.000	400.00	102.64	.12	.00	.00	11.23	.10
12.000	500.00	102.90	.27	.00	.00	11.24	.10
12.000	600.00	103.30	.40	.00	.00	11.25	.10
12.000	700.00	103.67	.36	.00	.00	11.26	.10
12.000	800.00	104.06	.39	.00	.00	11.27	.10
12.000	900.00	104.44	.39	.00	.00	11.28	.10
13.000	100.00	102.50	.00	.00	00	11.22	55.00
13.000	200.00	102.50	.00	.01	.00	11.22	55.00
13.000	300.00	102.54	.04	.02	.00	11.23	55.00
13.000	400.00	102.68	.14	.04	.00	11.23	55.00
13.000	500.00	102.96	.29	.06	00	11.24	55.00
13.000	600.00	103.38	.42	.08	.00	11.25	55.00
13.000	700.00	103.77	.38	.10	.00	11.26	55.00
13.000	800.00	104.18	.41	.12	.00	11.27	55.00
13.000	900.00	104.59	.41	.15	00	11.28	55.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	14.000	100.00	102.51	.00	.02	.00	22.52	6.00
*	14.000	200.00	102.56	.05	.07	.00	22.52	6.00
*	14.000	300.00	102.69	.13	.15	.00	22.52	6.00
*	14.000	400.00	102.95	.25	.27	.00	22.53	6.00
*	14.000	500.00	103.36	.41	.39	.00	22.53	6.00
*	14.000	600.00	103.90	.55	.52	.00	22.54	6.00
*	14.000	700.00	104.43	.52	.66	.00	22.55	6.00
*	14.000	800.00	104.98	.55	.79	.00	22.56	6.00
*	14.000	900.00	105.53	.55	.93	.00	22.56	6.00
	15.000	100.00	102.54	.00	.03	.00	22.53	12.10
	15.000	200.00	102.68	.14	.12	.00	22.53	12.10
	15.000	300.00	102.96	.28	.27	.00	22.54	12.10
	15.000	400.00	103.43	.47	.48	.00	22.54	12.10
	15.000	500.00	104.12	.69	.77	.00	22.55	12.10
	15.000	600.00	105.02	.90	1.12	.00	22.56	12.10
	15.000	700.00	105.96	.94	1.54	.00	22.58	12.10
	15.000	800.00	107.00	1.04	2.02	.00	22.59	12.10
	15.000	900.00	108.11	1.11	2.58	.00	22.60	12.10
*	16.000	100.00	102.55	.00	.00	.00	39.90	20.00
*	16.000	200.00	102.70	.15	.01	.00	39.91	20.00
*	16.000	300.00	102.99	.29	.03	.00	39.91	20.00
*	16.000	400.00	103.47	.48	.04	.00	39.91	20.00
*	16.000	500.00	104.18	.71	.06	.00	39.92	20.00
*	16.000	600.00	105.09	.91	.07	.00	39.93	20.00
*	16.000	700.00	106.05	.95	.09	.00	39.94	20.00
*	16.000	800.00	107.09	1.05	.10	.00	39.96	20.00
*	16.000	900.00	108.21	1.12	.10	.00	39.97	20.00
*	17.000	100.00	102.55	.00	.00	.00	645.90	80.00
*	17.000	200.00	102.70	.16	.01	.00	667.46	80.00
*	17.000	300.00	103.00	.30	.01	.00	709.14	80.00
*	17.000	400.00	103.49	.49	.02	.00	777.07	80.00
*	17.000	500.00	104.21	.72	.03	.00	876.65	80.00
*	17.000	600.00	105.13	.92	.03	.00	1003.86	80.00
*	17.000	700.00	106.09	.96	.04	.00	1136.80	80.00
*	17.000	800.00	107.14	1.05	.04	.00	1282.79	80.00
*	17.000	900.00	108.26	1.12	.05	.00	1438.12	80.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 2.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 2.000 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 2.000 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

```
WARNING SECNO=      2.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.000  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.000  PROFILE=  7  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.000  PROFILE=  8  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.000  PROFILE=  9  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      3.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.000  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.000  PROFILE=  7  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.000  PROFILE=  8  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.000  PROFILE=  9  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      5.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  7  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  8  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.000  PROFILE=  9  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      7.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  7  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  8  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.000  PROFILE=  9  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      8.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  7  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  8  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.000  PROFILE=  9  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     14.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
1
   07AUG92       17:19:50                                                PAGE   21

WARNING SECNO=     14.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     14.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     14.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     14.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
```

APPENDIX B

SAMPLE HYDROLOGIC ROUTING OUTPUT

```
1STAGE(I)     -6.00     -3.70       .00      1.00      2.00      3.00      4.00      6.00      8.00     10.00

 VOL(I)         .00     54.00    454.00    720.00   1114.00   1780.00   2802.00   5413.00   8359.00  11604.00

 TINC,FLOIN(I)
              60.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00

 TINC,FLOIN(I)
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00

 TINC,FLOIN(I)
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
              13.00     13.00     13.00

 TINC,FLOIN(I)
              13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00

 TINC2,TIDES(I)
                .00

 NINVERT,NWIDTH,CN1,CN2
                .00       .00       .00       .00

 FINVERT,FWIDTH,FSOFF,FNUM,CF1,CF2,CF3
              -4.70      4.00       .70      4.00     -1.00     -1.00     -1.00

 CF1E10,CF1E20,CF2L10,CF2L20,CF3LN10,CF3LN20
            .0538388  .2925720  .0366667  .0533333  .7041340 -.9972790

 CF1E1I,CF1E2I,CF2L1I,CF2L2I,CF3E1I,CF3E2I
            .0745290  .2151150  .0220000  .2020000  .2198810  .0554910

 TSTEP,END,PRNT,A,STUFF,WESVIL,TUNE,ITMAX
              15.00    160.00    120.00      7.35        0.        1.      .100      600.

 STAG1,TIDE1,POOLOW
              -4.70     -7.20       .00                                ELEVATIONS ARE FT., NGVD

 HOURS,IN1,STAG1,STOR1,OUT1
                .00     13.00     -4.70     30.52       .00

    HOURS      IN    STAG    STOR     OUT       QN   NAREA       TN      VN      QF   FAREA      TF      VF  TOTVOL     TIDE    ITER

  120.000    751.    2.00   1117.      0.       0.      .0       0.      .0   -738.    86.4     -1.    -8.5  -1086.     6.10      29
```

```
1STAGE(I)    -6.00     -3.70       .00      1.00      2.00      3.00      4.00      6.00      8.00     10.00

 VOL(I)        .00     54.00    454.00    720.00   1114.00   1780.00   2802.00   5413.00   8359.00  11604.00

 TINC,FLOIN(I)
             60.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00

 TINC,FLOIN(I)
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00

 TINC,FLOIN(I)
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00
             13.00     13.00     13.00

 TINC,FLOIN(I)
             13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00     13.00

 TINC2,TIDES(I)
               .00

 NINVERT,NWIDTH,CN1,CN2
               .00       .00       .00       .00

 FINVERT,FWIDTH,FSOFF,FNUM,CF1,CF2,CF3
             -4.70      4.00       .70      4.00     -1.00     -1.00     -1.00

 CF1E1O,CF1E2O,CF2L1O,CF2L2O,CF3LN1O,CF3LN2O
          .0538388  .2925720  .0366667  .0533333  .7041340 -.9972790

 CF1E1I,CF1E2I,CF2L1I,CF2L2I,CF3E1I,CF3E2I
          .0745290  .2151150  .0220000  .2020000  .2198810  .0554910

 TSTEP,END,PRNT,A,STUFF,WESVIL,TUNE,ITMAX
             15.00    160.00    120.00      7.35        0.        1.      .100      600.

 STAG1,TIDE1,POOLOW
             -4.70     -7.20       .00

 HOURS,IN1,STAG1,STOR1,OUT1
               .00     13.00     -4.70     30.52       .00
```

HOURS	IN	STAG	STOR	OUT	QN	NAREA	TN	VN	QF	FAREA	TF	VF	TOTVOL	TIDE	ITER
120.000	751.	2.00	1117.	0.	0.	.0	0.	.0	-738.	86.4	-1.	-8.5	-1086.	6.10	29

CFA,CFB,CFC		.38	.00	.00											
123.750	13.	1.91	1077.	503.	0.	.0	0.	.0	503.	86.4	1.	5.8	-1046.	-5.80	22
CFA,CFB,CFC		.37	.00	.00											
124.000	13.	1.88	1067.	488.	0.	.0	0.	.0	488.	86.4	1.	5.6	-1036.	-6.29	27
CFA,CFB,CFC		.36	.00	.00											
124.250	13.	1.86	1057.	476.	0.	.0	0.	.0	476.	86.4	1.	5.5	-1026.	-6.68	22
CFA,CFB,CFC		.35	.00	.00											
124.500	13.	1.83	1048.	467.	0.	.0	0.	.0	467.	86.4	1.	5.4	-1017.	-6.97	26
CFA,CFB,CFC		.34	.00	.00											
124.750	13.	1.81	1038.	462.	0.	.0	0.	.0	462.	86.4	1.	5.3	-1008.	-7.14	20
CFA,CFB,CFC		.34	.00	.00											
125.000	13.	1.78	1029.	459.	0.	.0	0.	.0	459.	86.4	1.	5.3	-998.	-7.20	25
CFA,CFB,CFC		.34	.00	.00											
125.250	13.	1.76	1020.	459.	0.	.0	0.	.0	459.	86.4	1.	5.3	-989.	-7.14	17
CFA,CFB,CFC		.34	.00	.00											
125.500	13.	1.74	1011.	462.	0.	.0	0.	.0	462.	86.4	1.	5.3	-980.	-6.97	17
CFA,CFB,CFC		.34	.00	.00											
125.750	13.	1.71	1001.	467.	0.	.0	0.	.0	467.	86.4	1.	5.4	-971.	-6.68	25
CFA,CFB,CFC		.35	.00	.00											
126.000	13.	1.69	992.	476.	0.	.0	0.	.0	476.	86.4	1.	5.5	-961.	-6.29	21
CFA,CFB,CFC		.36	.00	.00											
126.250	13.	1.67	982.	487.	0.	.0	0.	.0	487.	86.4	1.	5.6	-952.	-5.80	29
CFA,CFB,CFC		.37	.00	.00											
126.500	13.	1.64	972.	501.	0.	.0	0.	.0	501.	86.4	1.	5.8	-942.	-5.21	25
CFA,CFB,CFC		.38	.00	.00											
126.750	13.	1.61	962.	518.	0.	.0	0.	.0	518.	86.4	1.	6.0	-931.	-4.54	29
CFA,CFB,CFC		.39	.00	.00											
127.000	13.	1.59	951.	537.	0.	.0	0.	.0	537.	86.4	1.	6.2	-921.	-3.79	20

CFA,CFB,CFC		.41	.00	.00											
127.250	13.	1.56	940.	558.	0.	.0	0.	.0	558.	86.4	1.	6.5	-910.	-2.98	36
CFA,CFB,CFC		.43	.00	.00											
127.500	13.	1.53	929.	582.	0.	.0	0.	.0	582.	86.4	1.	6.7	-898.	-2.12	31
CFA,CFB,CFC		.45	.00	.00											
127.750	13.	1.50	917.	537.	0.	.0	0.	.0	537.	86.4	1.	6.2	-887.	-1.23	26
CFA,CFB,CFC		.47	.00	.00											
128.000	13.	1.48	907.	457.	0.	.0	0.	.0	457.	86.4	1.	5.3	-877.	-.31	32
CFA,CFB,CFC		.49	.00	.00											
128.250	13.	1.46	900.	330.	0.	.0	0.	.0	330.	86.4	1.	3.8	-869.	.61	29
CFA,CFB,CFC		.52	.00	.00											
128.500	110.	1.45	897.	0.	0.	.0	0.	.0	-97.	86.4	-1.	-1.1	-867.	1.53	38
CFA,CFB,CFC		.50	.00	.00											
128.750	356.	1.46	902.	0.	0.	.0	0.	.0	-343.	86.4	-1.	-4.0	-872.	2.42	17
CFA,CFB,CFC		.51	.00	.00											
129.000	483.	1.48	911.	0.	0.	.0	0.	.0	-470.	86.4	-1.	-5.4	-880.	3.28	43
CFA,CFB,CFC		.51	.00	.00											
129.250	578.	1.51	922.	0.	0.	.0	0.	.0	-565.	86.4	-1.	-6.5	-891.	4.09	27
CFA,CFB,CFC		.51	.00	.00											
129.500	653.	1.54	935.	0.	0.	.0	0.	.0	-640.	86.4	-1.	-7.4	-904.	4.84	38
CFA,CFB,CFC		.51	.00	.00											
129.750	714.	1.58	949.	0.	0.	.0	0.	.0	-701.	86.4	-1.	-8.1	-918.	5.51	37
CFA,CFB,CFC		.51	.00	.00											
130.000	763.	1.62	964.	0.	0.	.0	0.	.0	-750.	86.4	-1.	-8.7	-933.	6.10	31
CFA,CFB,CFC		.51	.00	.00											
130.250	803.	1.66	980.	0.	0.	.0	0.	.0	-790.	86.4	-1.	-9.1	-950.	6.59	23
CFA,CFB,CFC		.51	.00	.00											
130.500	833.	1.70	997.	0.	0.	.0	0.	.0	-820.	86.4	-1.	-9.5	-966.	6.98	22

CFA,CFB,CFC		.51	.00	.00											
130.750	854.	1.75	1014.	0.	0.	.0	0.	.0	-841.	86.4	-1.	-9.7	-984.	7.27	22
CFA,CFB,CFC		.52	.00	.00											
131.000	867.	1.79	1032.	0.	0.	.0	0.	.0	-854.	86.4	-1.	-9.9	-1002.	7.44	25
CFA,CFB,CFC		.52	.00	.00											
131.250	871.	1.84	1050.	0.	0.	.0	0.	.0	-858.	86.4	-1.	-9.9	-1020.	7.50	16
CFA,CFB,CFC		.52	.00	.00											
131.500	866.	1.88	1068.	0.	0.	.0	0.	.0	-853.	86.4	-1.	-9.9	-1038.	7.44	27
CFA,CFB,CFC		.52	.00	.00											
131.750	852.	1.93	1086.	0.	0.	.0	0.	.0	-839.	86.4	-1.	-9.7	-1055.	7.27	31
CFA,CFB,CFC		.52	.00	.00											
132.000	828.	1.97	1103.	0.	0.	.0	0.	.0	-815.	86.4	-1.	-9.4	-1073.	6.98	39
CFA,CFB,CFC		.53	.00	.00											
132.250	794.	2.01	1120.	0.	0.	.0	0.	.0	-781.	86.4	-1.	-9.0	-1089.	6.59	42
CFA,CFB,CFC		.53	.00	.00											
132.500	750.	2.03	1136.	0.	0.	.0	0.	.0	-737.	86.4	-1.	-8.5	-1105.	6.10	35
CFA,CFB,CFC		.53	.00	.00											
132.750	694.	2.06	1151.	0.	0.	.0	0.	.0	-681.	86.4	-1.	-7.9	-1120.	5.51	27
CFA,CFB,CFC		.53	.00	.00											
133.000	622.	2.08	1164.	0.	0.	.0	0.	.0	-609.	86.4	-1.	-7.1	-1134.	4.84	29
CFA,CFB,CFC		.53	.00	.00											
133.250	532.	2.09	1176.	0.	0.	.0	0.	.0	-519.	86.4	-1.	-6.0	-1146.	4.09	32
CFA,CFB,CFC		.53	.00	.00											
133.500	411.	2.11	1186.	0.	0.	.0	0.	.0	-398.	86.4	-1.	-4.6	-1156.	3.28	40
CFA,CFB,CFC		.53	.00	.00											
133.750	216.	2.12	1193.	0.	0.	.0	0.	.0	-203.	86.4	-1.	-2.3	-1162.	2.42	31
CFA,CFB,CFC		.53	.00	.00											
134.000	13.	2.12	1192.	290.	0.	.0	0.	.0	290.	86.4	1.	3.4	-1161.	1.53	37

CFA,CFB,CFC		.54	.00	.00											
134.250	13.	2.11	1185.	439.	0.	.0	0.	.0	439.	86.4	1.	5.1	-1154.	.61	22
CFA,CFB,CFC		.52	.00	.00											
134.500	13.	2.09	1175.	530.	0.	.0	0.	.0	530.	86.4	1.	6.1	-1144.	-.31	39
CFA,CFB,CFC		.49	.00	.00											
134.750	13.	2.07	1164.	591.	0.	.0	0.	.0	591.	86.4	1.	6.8	-1133.	-1.23	30
CFA,CFB,CFC		.47	.00	.00											
135.000	13.	2.06	1151.	624.	0.	.0	0.	.0	624.	86.4	1.	7.2	-1121.	-2.12	32
CFA,CFB,CFC		.45	.00	.00											
135.250	13.	2.04	1139.	595.	0.	.0	0.	.0	595.	86.4	1.	6.9	-1108.	-2.98	46
CFA,CFB,CFC		.43	.00	.00											
135.500	13.	2.02	1127.	568.	0.	.0	0.	.0	568.	86.4	1.	6.6	-1097.	-3.79	22
CFA,CFB,CFC		.41	.00	.00											
135.750	13.	2.00	1116.	545.	0.	.0	0.	.0	545.	86.4	1.	6.3	-1085.	-4.54	38
CFA,CFB,CFC		.39	.00	.00											
136.000	13.	1.98	1105.	524.	0.	.0	0.	.0	524.	86.4	1.	6.1	-1075.	-5.21	14
CFA,CFB,CFC		.38	.00	.00											
136.250	13.	1.95	1095.	506.	0.	.0	0.	.0	506.	86.4	1.	5.9	-1064.	-5.80	15
CFA,CFB,CFC		.37	.00	.00											
136.500	13.	1.93	1085.	491.	0.	.0	0.	.0	491.	86.4	1.	5.7	-1054.	-6.29	27
CFA,CFB,CFC		.36	.00	.00											
136.750	13.	1.90	1075.	479.	0.	.0	0.	.0	479.	86.4	1.	5.5	-1045.	-6.68	21
CFA,CFB,CFC		.35	.00	.00											
137.000	13.	1.88	1066.	470.	0.	.0	0.	.0	470.	86.4	1.	5.4	-1035.	-6.97	26
CFA,CFB,CFC		.34	.00	.00											
137.250	13.	1.85	1056.	464.	0.	.0	0.	.0	464.	86.4	1.	5.4	-1026.	-7.14	20
CFA,CFB,CFC		.34	.00	.00											
137.500	13.	1.83	1047.	462.	0.	.0	0.	.0	462.	86.4	1.	5.3	-1016.	-7.20	24

CFA,CFB,CFC		.34	.00	.00											
137.750	13.	1.81	1038.	462.	0.	.0	0.	.0	462.	86.4	1.	5.3	-1007.	-7.14	17
CFA,CFB,CFC		.34	.00	.00											
138.000	13.	1.78	1028.	464.	0.	.0	0.	.0	464.	86.4	1.	5.4	-998.	-6.97	17
CFA,CFB,CFC		.34	.00	.00											
138.250	13.	1.76	1019.	470.	0.	.0	0.	.0	470.	86.4	1.	5.4	-988.	-6.68	24
CFA,CFB,CFC		.35	.00	.00											
138.500	13.	1.73	1009.	479.	0.	.0	0.	.0	479.	86.4	1.	5.5	-979.	-6.29	21
CFA,CFB,CFC		.36	.00	.00											
138.750	13.	1.71	1000.	490.	0.	.0	0.	.0	490.	86.4	1.	5.7	-969.	-5.80	28
CFA,CFB,CFC		.37	.00	.00											
139.000	13.	1.68	990.	504.	0.	.0	0.	.0	504.	86.4	1.	5.8	-959.	-5.21	25
CFA,CFB,CFC		.38	.00	.00											
139.250	13.	1.66	979.	521.	0.	.0	0.	.0	521.	86.4	1.	6.0	-949.	-4.54	34
CFA,CFB,CFC		.39	.00	.00											
139.500	13.	1.63	969.	540.	0.	.0	0.	.0	540.	86.4	1.	6.3	-938.	-3.79	26
CFA,CFB,CFC		.41	.00	.00											
139.750	13.	1.60	958.	562.	0.	.0	0.	.0	562.	86.4	1.	6.5	-927.	-2.98	42
CFA,CFB,CFC		.43	.00	.00											
140.000	13.	1.57	946.	586.	0.	.0	0.	.0	586.	86.4	1.	6.8	-915.	-2.12	27
CFA,CFB,CFC		.45	.00	.00											
140.250	13.	1.54	935.	542.	0.	.0	0.	.0	542.	86.4	1.	6.3	-904.	-1.23	25
CFA,CFB,CFC		.47	.00	.00											
140.500	13.	1.52	924.	462.	0.	.0	0.	.0	462.	86.4	1.	5.4	-894.	-.31	36
CFA,CFB,CFC		.49	.00	.00											
140.750	13.	1.50	916.	338.	0.	.0	0.	.0	338.	86.4	1.	3.9	-886.	.61	32
CFA,CFB,CFC		.52	.00	.00											
141.000	79.	1.49	914.	0.	0.	.0	0.	.0	-66.	86.4	-1.	-.8	-883.	1.53	32

CFA,CFB,CFC		.51	.00	.00										
141.250	350.	1.50	918.	0.	0.	.0	0.	.0	-337.	86.4	-1.	-3.9	-888.	2.42	28
CFA,CFB,CFC		.51	.00	.00										
141.500	479.	1.53	927.	0.	0.	.0	0.	.0	-466.	86.4	-1.	-5.4	-896.	3.28	37
CFA,CFB,CFC		.51	.00	.00										
141.750	575.	1.55	938.	0.	0.	.0	0.	.0	-562.	86.4	-1.	-6.5	-907.	4.09	23
CFA,CFB,CFC		.51	.00	.00										
142.000	651.	1.58	950.	0.	0.	.0	0.	.0	-638.	86.4	-1.	-7.4	-920.	4.84	29
CFA,CFB,CFC		.51	.00	.00										
142.250	712.	1.62	965.	0.	0.	.0	0.	.0	-699.	86.4	-1.	-8.1	-934.	5.51	35
CFA,CFB,CFC		.51	.00	.00										
142.500	762.	1.66	980.	0.	0.	.0	0.	.0	-749.	86.4	-1.	-8.7	-949.	6.10	27
CFA,CFB,CFC		.51	.00	.00										
142.750	802.	1.70	996.	0.	0.	.0	0.	.0	-789.	86.4	-1.	-9.1	-965.	6.59	28
CFA,CFB,CFC		.51	.00	.00										
143.000	832.	1.74	1013.	0.	0.	.0	0.	.0	-819.	86.4	-1.	-9.5	-982.	6.98	26
CFA,CFB,CFC		.52	.00	.00										
143.250	854.	1.79	1030.	0.	0.	.0	0.	.0	-841.	86.4	-1.	-9.7	-1000.	7.27	25
CFA,CFB,CFC		.52	.00	.00										
143.500	866.	1.83	1048.	0.	0.	.0	0.	.0	-853.	86.4	-1.	-9.9	-1017.	7.44	28
CFA,CFB,CFC		.52	.00	.00										
143.750	870.	1.88	1066.	0.	0.	.0	0.	.0	-857.	86.4	-1.	-9.9	-1035.	7.50	24
CFA,CFB,CFC		.52	.00	.00										
144.000	865.	1.92	1084.	0.	0.	.0	0.	.0	-852.	86.4	-1.	-9.9	-1053.	7.44	30
CFA,CFB,CFC		.52	.00	.00										
144.250	851.	1.97	1102.	0.	0.	.0	0.	.0	-838.	86.4	-1.	-9.7	-1071.	7.27	28
CFA,CFB,CFC		.52	.00	.00										
144.500	827.	2.01	1119.	0.	0.	.0	0.	.0	-814.	86.4	-1.	-9.4	-1088.	6.98	30

CFA,CFB,CFC		.53	.00	.00											
144.750	794.	2.03	1136.	0.	0.	.0	0.	.0	-781.	86.4	-1.	-9.0	-1105.	6.59	39
CFA,CFB,CFC		.53	.00	.00											
145.000	749.	2.06	1152.	0.	0.	.0	0.	.0	-736.	86.4	-1.	-8.5	-1121.	6.10	36
CFA,CFB,CFC		.53	.00	.00											
145.250	692.	2.08	1167.	0.	0.	.0	0.	.0	-679.	86.4	-1.	-7.9	-1136.	5.51	24
CFA,CFB,CFC		.53	.00	.00											
145.500	621.	2.10	1180.	0.	0.	.0	0.	.0	-608.	86.4	-1.	-7.0	-1149.	4.84	26
CFA,CFB,CFC		.53	.00	.00											
145.750	530.	2.12	1192.	0.	0.	.0	0.	.0	-517.	86.4	-1.	-6.0	-1161.	4.09	34
CFA,CFB,CFC		.53	.00	.00											
146.000	408.	2.13	1202.	0.	0.	.0	0.	.0	-395.	86.4	-1.	-4.6	-1171.	3.28	39
CFA,CFB,CFC		.53	.00	.00											
146.250	208.	2.14	1208.	0.	0.	.0	0.	.0	-195.	86.4	-1.	-2.3	-1177.	2.42	34
CFA,CFB,CFC		.53	.00	.00											
146.500	13.	2.14	1207.	295.	0.	.0	0.	.0	295.	86.4	1.	3.4	-1177.	1.53	24
CFA,CFB,CFC		.54	.00	.00											
146.750	13.	2.13	1200.	442.	0.	.0	0.	.0	442.	86.4	1.	5.1	-1169.	.61	19
CFA,CFB,CFC		.52	.00	.00											
147.000	13.	2.11	1190.	532.	0.	.0	0.	.0	532.	86.4	1.	6.2	-1159.	-.31	31
CFA,CFB,CFC		.49	.00	.00											
147.250	13.	2.10	1179.	593.	0.	.0	0.	.0	593.	86.4	1.	6.9	-1148.	-1.23	34
CFA,CFB,CFC		.47	.00	.00											
147.500	13.	2.08	1166.	626.	0.	.0	0.	.0	626.	86.4	1.	7.2	-1136.	-2.12	26
CFA,CFB,CFC		.45	.00	.00											
147.750	13.	2.06	1154.	597.	0.	.0	0.	.0	597.	86.4	1.	6.9	-1123.	-2.98	36
CFA,CFB,CFC		.43	.00	.00											
148.000	13.	2.04	1142.	570.	0.	.0	0.	.0	570.	86.4	1.	6.6	-1112.	-3.79	28

CFA,CFB,CFC		.38	.00	.00											
151.750	13.	1.69	994.	523.	0.	.0	0.	.0	523.	86.4	1.	6.1	-963.	-4.54	36
CFA,CFB,CFC		.39	.00	.00											
152.000	13.	1.67	983.	543.	0.	.0	0.	.0	543.	86.4	1.	6.3	-952.	-3.79	29
CFA,CFB,CFC		.41	.00	.00											
152.250	13.	1.64	972.	565.	0.	.0	0.	.0	565.	86.4	1.	6.5	-941.	-2.98	35
CFA,CFB,CFC		.43	.00	.00											
152.500	13.	1.61	960.	589.	0.	.0	0.	.0	589.	86.4	1.	6.8	-930.	-2.12	31
CFA,CFB,CFC		.45	.00	.00											
152.750	13.	1.58	949.	545.	0.	.0	0.	.0	545.	86.4	1.	6.3	-918.	-1.23	42
CFA,CFB,CFC		.47	.00	.00											
153.000	13.	1.55	938.	467.	0.	.0	0.	.0	467.	86.4	1.	5.4	-908.	-.31	34
CFA,CFB,CFC		.49	.00	.00											
153.250	13.	1.53	930.	345.	0.	.0	0.	.0	345.	86.4	1.	4.0	-900.	.61	28
CFA,CFB,CFC		.52	.00	.00											
153.500	26.	1.53	927.	0.	0.	.0	0.	.0	-13.	86.4	-1.	-.2	-897.	1.53	33
CFA,CFB,CFC		.51	.00	.00											
153.750	345.	1.54	931.	0.	0.	.0	0.	.0	-332.	86.4	-1.	-3.8	-900.	2.42	25
CFA,CFB,CFC		.51	.00	.00											
154.000	476.	1.56	940.	0.	0.	.0	0.	.0	-463.	86.4	-1.	-5.4	-909.	3.28	37
CFA,CFB,CFC		.51	.00	.00											
154.250	573.	1.58	950.	0.	0.	.0	0.	.0	-560.	86.4	-1.	-6.5	-920.	4.09	26
CFA,CFB,CFC		.51	.00	.00											
154.500	649.	1.62	963.	0.	0.	.0	0.	.0	-636.	86.4	-1.	-7.4	-932.	4.84	28
CFA,CFB,CFC		.51	.00	.00											
154.750	711.	1.65	977.	0.	0.	.0	0.	.0	-698.	86.4	-1.	-8.1	-946.	5.51	42
CFA,CFB,CFC		.51	.00	.00											
155.000	761.	1.69	992.	0.	0.	.0	0.	.0	-748.	86.4	-1.	-8.7	-962.	6.10	32

CFA,CFB,CFC		.41	.00	.00											
148.250	13.	2.03	1131.	546.	0.	.0	0.	.0	546.	86.4	1.	6.3	-1100.	-4.54	33
CFA,CFB,CFC		.39	.00	.00											
148.500	13.	2.01	1120.	526.	0.	.0	0.	.0	526.	86.4	1.	6.1	-1090.	-5.21	24
CFA,CFB,CFC		.38	.00	.00											
148.750	13.	1.99	1110.	508.	0.	.0	0.	.0	508.	86.4	1.	5.9	-1079.	-5.80	21
CFA,CFB,CFC		.37	.00	.00											
149.000	13.	1.96	1100.	493.	0.	.0	0.	.0	493.	86.4	1.	5.7	-1069.	-6.29	19
CFA,CFB,CFC		.36	.00	.00											
149.250	13.	1.94	1090.	481.	0.	.0	0.	.0	481.	86.4	1.	5.6	-1059.	-6.68	21
CFA,CFB,CFC		.35	.00	.00											
149.500	13.	1.91	1080.	472.	0.	.0	0.	.0	472.	86.4	1.	5.5	-1050.	-6.97	26
CFA,CFB,CFC		.34	.00	.00											
149.750	13.	1.89	1071.	467.	0.	.0	0.	.0	467.	86.4	1.	5.4	-1040.	-7.14	20
CFA,CFB,CFC		.34	.00	.00											
150.000	13.	1.87	1062.	464.	0.	.0	0.	.0	464.	86.4	1.	5.4	-1031.	-7.20	24
CFA,CFB,CFC		.34	.00	.00											
150.250	13.	1.84	1052.	464.	0.	.0	0.	.0	464.	86.4	1.	5.4	-1022.	-7.14	17
CFA,CFB,CFC		.34	.00	.00											
150.500	13.	1.82	1043.	467.	0.	.0	0.	.0	467.	86.4	1.	5.4	-1012.	-6.97	17
CFA,CFB,CFC		.34	.00	.00											
150.750	13.	1.80	1033.	472.	0.	.0	0.	.0	472.	86.4	1.	5.5	-1003.	-6.68	24
CFA,CFB,CFC		.35	.00	.00											
151.000	13.	1.77	1024.	481.	0.	.0	0.	.0	481.	86.4					

CFA,CFB,CFC .38 .00 .00

151.750	13.	1.69	994.	523.	0.	.0	0.	.0	523.	86.4	1.	6.1	-963.	-4.54	36

CFA,CFB,CFC .39 .00 .00

152.000	13.	1.67	983.	543.	0.	.0	0.	.0	543.	86.4	1.	6.3	-952.	-3.79	29

CFA,CFB,CFC .41 .00 .00

152.250	13.	1.64	972.	565.	0.	.0	0.	.0	565.	86.4	1.	6.5	-941.	-2.98	35

CFA,CFB,CFC .43 .00 .00

152.500	13.	1.61	960.	589.	0.	.0	0.	.0	589.	86.4	1.	6.8	-930.	-2.12	31

CFA,CFB,CFC .45 .00 .00

152.750	13.	1.58	949.	545.	0.	.0	0.	.0	545.	86.4	1.	6.3	-918.	-1.23	42

CFA,CFB,CFC .47 .00 .00

153.000	13.	1.55	938.	467.	0.	.0	0.	.0	467.	86.4	1.	5.4	-908.	-.31	34

CFA,CFB,CFC .49 .00 .00

153.250	13.	1.53	930.	345.	0.	.0	0.	.0	345.	86.4	1.	4.0	-900.	.61	28

CFA,CFB,CFC .52 .00 .00

153.500	26.	1.53	927.	0.	0.	.0	0.	.0	-13.	86.4	-1.	-.2	-897.	1.53	33

CFA,CFB,CFC .51 .00 .00

153.750	345.	1.54	931.	0.	0.	.0	0.	.0	-332.	86.4	-1.	-3.8	-900.	2.42	25

CFA,CFB,CFC .51 .00 .00

154.000	476.	1.56	940.	0.	0.	.0	0.	.0	-463.	86.4	-1.	-5.4	-909.	3.28	37

CFA,CFB,CFC .51 .00 .00

154.250	573.	1.58	950.	0.	0.	.0	0.	.0	-560.	86.4	-1.	-6.5	-920.	4.09	26

CFA,CFB,CFC .51 .00 .00

154.500	649.	1.62	963.	0.	0.	.0	0.	.0	-636.	86.4	-1.	-7.4	-932.	4.84	28

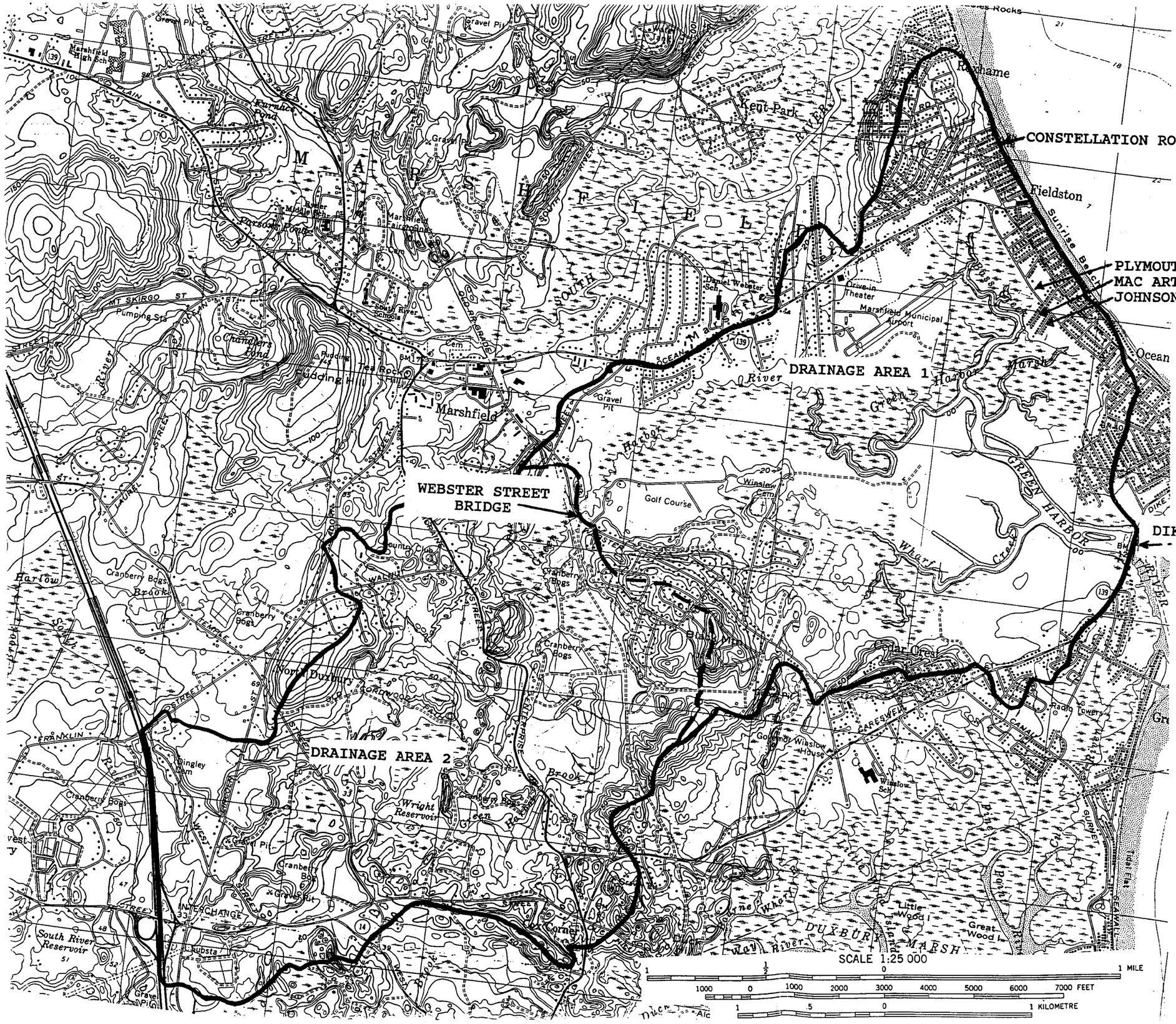
CFA,CFB,CFC .51 .00 .00

154.750	711.	1.65	977.	0.	0.	.0	0.	.0	-698.	86.4	-1.	-8.1	-946.	5.51	42

CFA,CFB,CFC .51 .00 .00

155.000	761.	1.69	992.	0.	0.	.0	0.	.0	-748.	86.4	-1.	-8.7	-962.	6.10	32

CFA,CFB,CFC		.51	.00	.00												
155.250	801.	1.73	1008.	0.	0.	.0	0.	.0	-788.	86.4	-1.	-9.1	-978.	6.59	21	
CFA,CFB,CFC		.52	.00	.00												
155.500	832.	1.77	1025.	0.	0.	.0	0.	.0	-819.	86.4	-1.	-9.5	-995.	6.98	30	
CFA,CFB,CFC		.52	.00	.00												
155.750	853.	1.82	1043.	0.	0.	.0	0.	.0	-840.	86.4	-1.	-9.7	-1012.	7.27	28	
CFA,CFB,CFC		.52	.00	.00												
156.000	866.	1.86	1060.	0.	0.	.0	0.	.0	-853.	86.4	-1.	-9.9	-1030.	7.44	30	
CFA,CFB,CFC		.52	.00	.00												
156.250	870.	1.91	1078.	0.	0.	.0	0.	.0	-857.	86.4	-1.	-9.9	-1048.	7.50	22	
CFA,CFB,CFC		.52	.00	.00												
156.500	865.	1.95	1096.	0.	0.	.0	0.	.0	-852.	86.4	-1.	-9.9	-1066.	7.44	32	
CFA,CFB,CFC		.52	.00	.00												
156.750	850.	2.00	1114.	0.	0.	.0	0.	.0	-837.	86.4	-1.	-9.7	-1083.	7.27	25	
CFA,CFB,CFC		.53	.00	.00												
157.000	827.	2.03	1131.	0.	0.	.0	0.	.0	-814.	86.4	-1.	-9.4	-1101.	6.98	24	
CFA,CFB,CFC		.53	.00	.00												
157.250	793.	2.05	1148.	0.	0.	.0	0.	.0	-780.	86.4	-1.	-9.0	-1117.	6.59	42	
CFA,CFB,CFC		.53	.00	.00												
157.500	749.	2.07	1164.	0.	0.	.0	0.	.0	-736.	86.4	-1.	-8.5	-1133.	6.10	43	
CFA,CFB,CFC		.53	.00	.00												
157.750	692.	2.10	1179.	0.	0.	.0	0.	.0	-679.	86.4	-1.	-7.9	-1148.	5.51	34	
CFA,CFB,CFC		.53	.00	.00												
158.000	620.	2.12	1192.	0.	0.	.0	0.	.0	-607.	86.4	-1.	-7.0	-1162.	4.84	37	
CFA,CFB,CFC		.53	.00	.00												
158.250	528.	2.14	1204.	0.	0.	.0	0.	.0	-515.	86.4	-1.	-6.0	-1174.	4.09	28	
CFA,CFB,CFC		.53	.00	.00												
158.500	405.	2.15	1214.	0.	0.	.0	0.	.0	-392.	86.4	-1.	-4.5	-1183.	3.28	32	



TOTAL DRAINAGE AREA: 7.21 Sq.Mi.

DRAINAGE AREA 1: 3.92 Sq.Mi.

DRAINAGE AREA 2: 3.29 Sq.Mi.

MARSHFIELD MA

COASTAL FLOODING IMPACT INVESTIGATION

PLATE 1